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A JAPANESE BIRD-CAGE.

BY PALGRAVE MORRISON.

SEVERAL correspondents of WORK have asked for a design of a Japanese bird-cage. One requested a model of a Chinese or Japanese house to adapt. As that was not feasible, I have here taken details from the celebrated "Mangwa" of the great artist, Hokusai, and endeavoured to make them serve the purpose required. How to construct it, except so far as the diagram explains itself, I cannot say, for I am sorry my ignorance of the Japanese language makes it impossible for me to transcribe what I have no doubt are clear instructions, and intelligible enough if I could only read them, but this I cannot do, as I have already tried to explain. The working details given in the aforesaid sketches proved also too elaborate to comprehend. Like the old woman who understood the "Pilgrim's Progress" itself, and hoped some day to understand the explanation of the allegory supplied by a thoughtful compiler at the end of the book, I yet live in hopes of doing so.

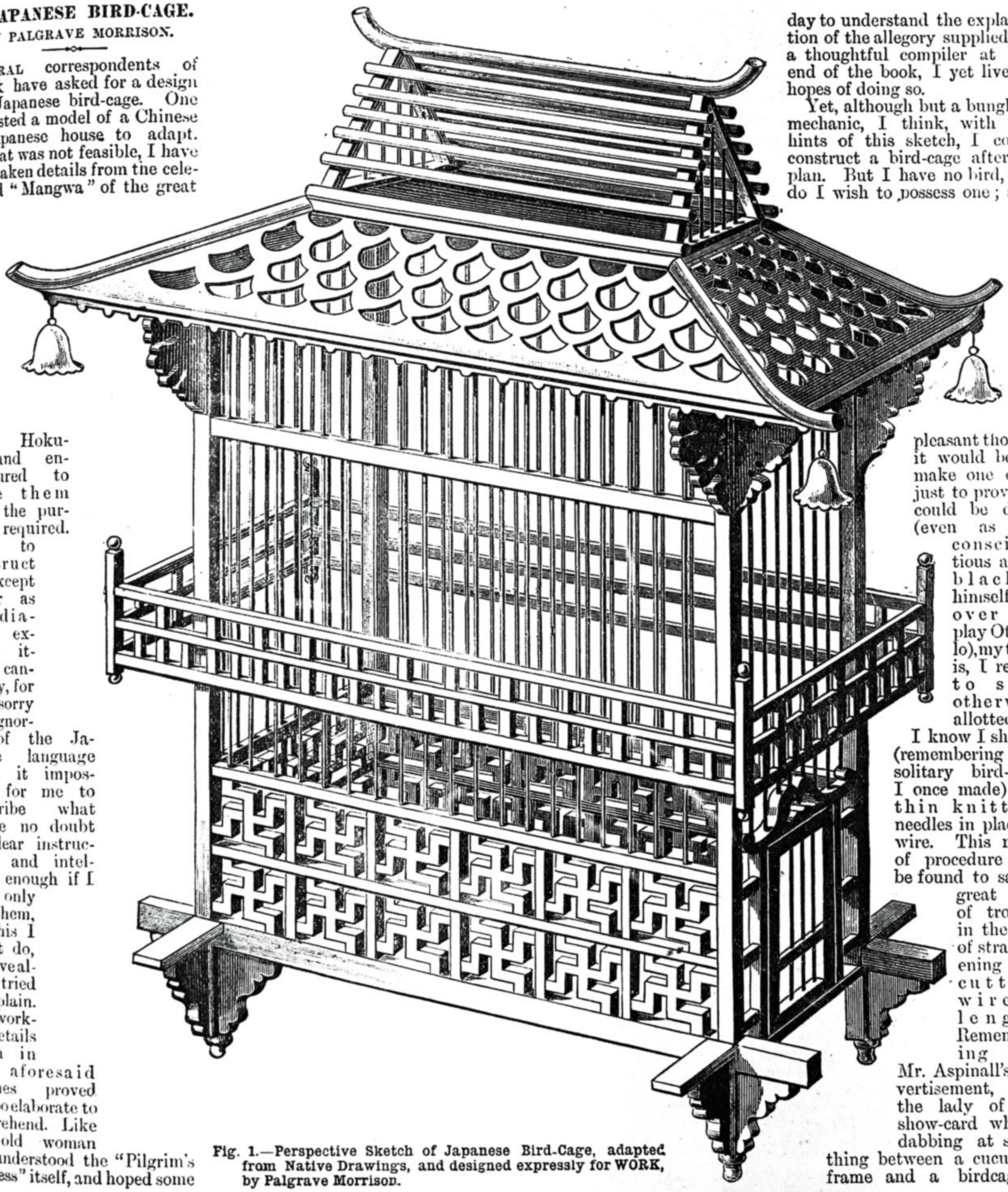

Fig. 1.—Perspective Sketch of Japanese Bird-Cage, adapted from Native Drawings, and designed expressly for WORK, by Palgrave Morrison.

Yet, although but a bungling mechanic, I think, with the hints of this sketch, I could construct a bird-cage after its plan. But I have no bird, nor do I wish to possess one; and pleasant though it would be to make one cage just to prove it could be done (even as the conscientious actor blacked himself all over to play Othello), my time is, I regret to say, otherwise allotted.

I know I should (remembering the solitary bird-cage I once made) use thin knitting needles in place of wire. This mode of procedure will be found to save a great deal of trouble in the way of straightening and cutting wire to length. Remembering also Mr. Aspinall's advertisement, and the lady of his show-card who is dabbing at something between a cucumber frame and a birdcage, I

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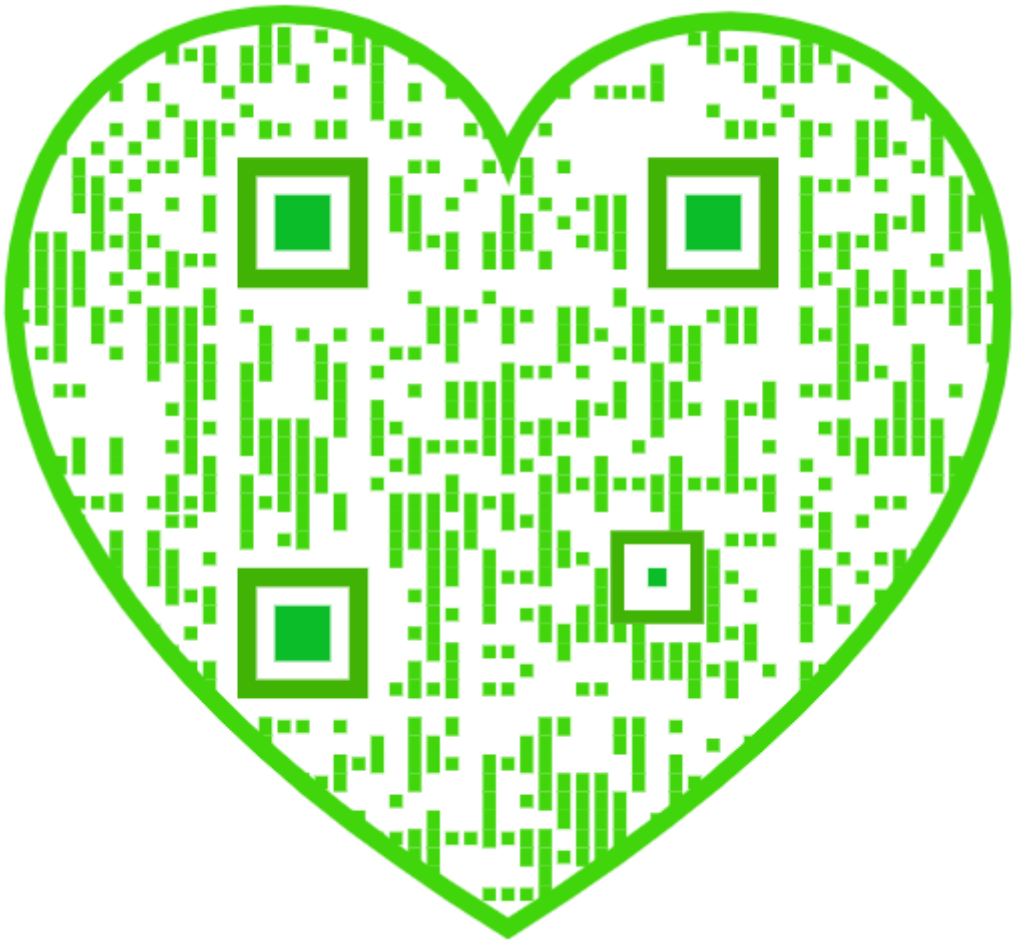

should try to dab also, and be happy if I could strike a visitor "unafraid with amazement," as the aforesaid pictorial anecdote shows us. I should also hinge the bottom of my cage for cleaning purposes, and make arrangements for supply of seed and water, and brackets to support the balcony, all forgotten in the sketch.

Its perspective is very shaky. An attempt to copy the curious perspective of the otherwise clever Japs, has resulted in a compromise that I am aware is not "English as she is drawed," nor "Japanese as she is sketched"; but it does, I hope, convey the general effect. And a tame right angle is kept in every house that may be trusted to prevent the worker from the eccentric angles depicted.

The roof is intended to be fret-cut in thin wood for the lower part, with rods as shown for the high-pitched gable. Fretwork is used for the pattern that surrounds these sides of the cage at foot. The balcony may be either joinery or fret-cut—preferably the former.

The size must be a matter of personal taste. The usual size is after all not such vague advice as the "historic lump of chalk," for a square cage to hold one bird, presupposing that it is the fidgety canary, rarely varies many inches.

Why the bells hang at the corners, and what they are made of, I don't know; but they were in one of the books, so I put them in; I hope it is all right. As the cage has a look as if it tried to be bamboo, but failed, perhaps a colour the shade of bamboo might be fit for its decoration. Bright sealing-wax red, with white bars, would look clean, and not less like genuine Japanese than most imitations. As any amateur who makes it must needs be a person with some cunning in his fingers, I do not think detailed drawings are needful, for the Japanese details refer to a full-size house; and although purists might insist that a model should be made the same way, to mortise a piece of wood of small section is not always the best joint. As a rule the columns of "Shop" are open to further explanation, but I do not think its publishers have a fount of Japanese type; and as I have said all I know about it here, there is little use promising to supply any other details elsewhere. So it must suffice to repeat the statement that it is Japanese—at least, stolen from Japanese sources; that it looks something like a bird-cage; and that if it cannot be constructed as the drawing shows, it is too late to blame anybody, for Hokusai died half a century ago; and if a man cannot be blamed who lived so long since, and so many thousand miles away, one might as well invent genuine details oneself, as be made responsible for other people's errors. To be sure, I may have misunderstood his drawings, and mixed them badly; but good or bad, the Japanese bird-cage had to be done, and here it is. Like the celebrated receipt for Chinese metaphysics, "Look up in an encyclopædia the articles on 'China' and 'Metaphysics,' and mix them," I have looked up "Bird-cage" and "Japanese," and mixed them, as you see.

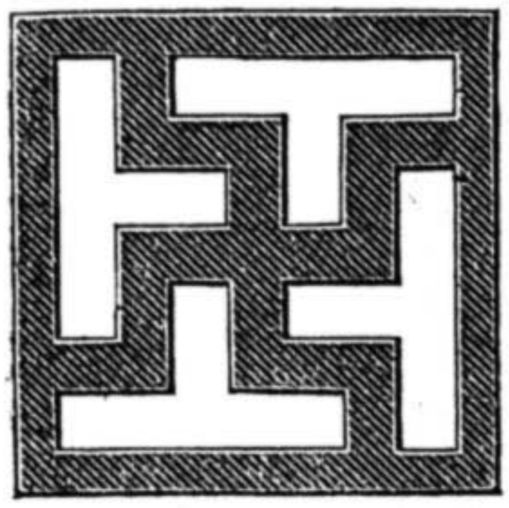

Fig. 2.—Detail of Fretwork.

A PLAIN CABINET BOOKCASE.

BY DAVID ADAMSON.

BOOKCASE OF WOOD FROM PACKING-CASES—SHAPING ENDS OF RECESS—PROJECTIONS AT TOP—PIECES COMPOSING TOP—TREATMENT—BEARERS FOR DRAWERS—DIVISION BETWEEN DRAWERS.

As I have referred to wood from packing-cases being suitable material for this cheap furniture, it may be as well, in order to prevent any misunderstanding, to say here that for this bookcase in its original form as shown, the necessary length for the ends cannot be got from this source. New wood, or at any rate planks sufficiently long, will have to be used, and it will be just as well for them to be of full inch stuff. Perhaps if they are made of ordinary 1¼ in. stuff, which will not be more than 1 in. "down," or when finished, it will be better. The boards should be selected, or at any rate two of them, a little wider than the depth from back to front of the upper cupboard, in order to save any unnecessary jointing. The extra width referred to is, of course, to allow for waste in cleaning up the edges. There will be no difficulty in obtaining boards sufficiently wide, and if another one of the same width be got, both the ends can be made from the three pieces. The two first referred to must, of course, be the full length of the ends, of which they will form the back portions. The third piece need not be longer than the height of the wider portions of the ends, as it will be assumed that by ripping it down the middle the required depth from back to front of these can be got with only one joint. By using a little method it will thus at once be seen that each end is formed of two pieces, needing only one joint to connect them. Without attention to such an apparently unimportant detail, or, rather let it be said, without the necessary forethought enabling the worker to determine how to use his stuff to the best advantage without waste of time, two or three joints might have been requisite to get the entire width or depth. If a word of caution to the novice may be given, it is this: never be in a hurry to commence any piece of furniture, but spend a little time in consideration of the various parts, and determine how the material available may be worked up without either unnecessary labour or waste in the shape of odd bits, or, as they are often called in the workshop, short ends. Though these are, strictly speaking, not waste, for they can be used up for small parts, they have a decided tendency to increase in altogether disproportionate quantity unless sharply looked after. Every cabinet-maker knows that to his cost; and addressing myself in this remark specially to the young artisan, *i.e.*, the professional worker, I would wish to impress on him the necessity of avoiding waste if he wants to advance himself.

By making the ends as suggested, the whole of the edges of the long boards can be planed up—or, to use a more technical word, "shot"—without more waste than is necessary to clean them. The "shaping" by the ends of the recess is merely a semicircle, the lower edge of which is 3 ft. 6 in. from the bottom of the piece. To set it out, open the compasses to 3½ in., measure 3 ft. 6 in. from the bottom end of the board, then place one leg of the compasses 3½ in. further, as near the front edge of the wood as convenient, and mark the line with the other. The waste can be removed with the bow saw. The shorter or front pieces of the ends, being 3 ft. 6 in. long, will then only have to be glued on carefully, all edges, of course, having being trued previously, and with a little additional cleaning up these parts are completed.

No reference, it will be noticed, has been made to the small projections at the top and bottom of the ends, as something will be said about them in due course.

We have now to consider the pieces by which the ends are connected. Without reckoning the parts which form the plinth and cornice, these will be five in number, all of exactly the same length, but differing in width according to places they are to occupy. The top piece, which we may call A, will be the same width as the ends; the next, B, forming the bottom of the upper part, will be a trifle narrower, for the open recess is fitted with a back which is nailed on behind this piece and the next lower one, and not between them. To arrive at the exact width of B it will therefore be only necessary to deduct the thickness of the backing-board or panel, for which it will not be necessary to use 1 in. stuff, as thinner will do equally well, from the width of the ends. The third piece, C, forming the top of the lower portion, will also be narrower to the same extent than the bottom of the cupboard E, which will be as wide as the ends at this part. As, however, the back of the bookcase will be "scribed," as it is called—*i.e.*, cut away to fit the skirting-board which is found in most rooms—it may here be suggested that it will save some trouble if allowance be made for doing this by making the back edge of the bottom so far forward that it will clear the skirting-board. Of course, this will only be practicable if the position the bookcase is to occupy when finished can be ascertained beforehand, but, as it may fairly be supposed that such a piece of furniture will only be for the maker's own use, the probability is that there will not be much difficulty in ascertaining the thickness of the skirting-board. Perhaps it will be better also, in such a case, to scribe the ends before making up the work, though naturally, in the course of ordinary business, the ends are generally fitted after the thing has been made. In some constructions scribing is not necessary, but in a bookcase made as this one is, it will be seen that unless the space for the skirting-board is cut away, the backs of the ends, etc., could not be close against the wall. There is certainly an alternative, but one which is not always convenient, viz., cutting away and removing a piece of the skirting-board from the wall where the bookcase is to stand. By the way, the skirting-board will have to be removed if the bookcase is to fit closely in a recess—not necessarily at the back, but certainly at the ends. But as the object is not so much just now to give instructions about fitting up in position as to tell how to make the bookcase, nothing more need be said.

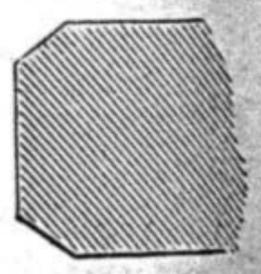

Fig. 4.—Chamfer on Edge.

The front edges of all these parts are bevelled or chamfered—not stop-chamfered, mind—as the ends of the job form the stops. An ordinary plane run along to remove the edges will do all that is necessary. The bevel should not be too wide, and will look best at an angle of 45°, as shown in Fig. 4, where the perpendicular line represents the front edge of the end. From this it will be seen that the flat edges of the shelves are level with the fronts of the ends.

As I have before pointed out, absolute

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squareness in ends and edges of all parts of this furniture is necessary, so too much care cannot be taken, not only in working the pieces up, but in arranging them. Mark out on the ends the exact position for the shelves, or, as they should rather be called, the tops and bottoms, and do not grudge any time that may be so bestowed. The quality of the work will be improved. I am aware that to many a novice this may be hard advice, almost like telling them to perform the impossible; but to prevent them experiencing disappointment with results, it is only right that they should be cautioned against the faults they are most apt to make. By free use of the square, not only in setting out but in testing, combined with patience and common sense, many blemishes may be avoided.

It will be most convenient to fix the boards A and E in first. They will be about 5 in. from the top and bottom respectively of the ends. It is, I suppose, almost unnecessary to remind anyone that nails will be used to fasten them, as enough was said in the opening chapter about the simple forms of construction adopted. Though nails alone might be used, it will be as well to glue in a few blocks above the top and below the bottom, where, as we shall see later on, they will not be observable. They will stiffen the structure, even although they may not be actually necessary. The piece C is fastened in with nails only, with a distance of three or four inches between each of them. As seen in Figs. 2, 3, page 362, it is fixed about an inch below the upper end of the wider portion. This is better than having them flush, as the projection forms a kind of protecting rail, to prevent books, etc., being knocked off, and the appearance is also improved.

The bottom of the upper cupboard is fixed in the same way, at, as has been indicated, a height of 9 in. above the top of the lower one.

We have still to attend to the bearer, or bottom of the space within which the drawers run. Like the others, it may go right to the back; but if it stops short three or four inches of the full width that might be used, it will not much matter. Of course, instead of using this board D, the drawer bearers, etc., may be constructed in the usual manner; but to say that they must be, and to give the necessary directions, would—as the simple construction mentioned will serve every purpose—be beyond the range of these chapters. Perhaps with regard to the width of this piece of wood—or bearer, to give it a technical name—it may be as well to direct attention to the fact that it is no use having a lock to the cupboard below, or taking any precautions against removal of contents from the back, if the drawer bearer is only narrow. It must be a certain width, or it will not hold the drawers firmly; but five or six inches would, probably, be enough for this. Such a narrow bearer would, therefore, be sufficient if all people were honest. Unfortunately, they are not; nor is the predatory lodging-house cat quite an extinct animal. No matter how carefully the cupboard might be locked, if the bearer is narrow, it is only necessary to remove the drawer to be able to insert a hand and get at any of the contents of the cupboard which may be within reach. How cats manage I can't say, for no one has ever actually seen them at this work; but as much of the cheaper kind of furniture is made with narrow bearers, most of the space behind, being open instead of closed, as it should be, by a board, the hint may be worth something to those who can't imagine what becomes of, etc. etc. Many mysterious disappearances which happen from sideboard cupboards and similar places may be explained by this very simple means. False keys are cumbersome and altogether unnecessary contrivances when the drawer bearer is narrow. The distance of the bearer below the top will, of course, be determined by the width of the drawer front, which we may take as $4\frac{1}{2}$ in., giving the drawer an inside depth of about 4 in.

The division between the two drawers may either be a piece of wood extending only three or four inches from the front, or it may go right to the back. In either case the grain of the wood must be upright. If it extends a good way back, it will serve as a guide to the drawers, and prevent them being forced inwards; but otherwise the desired object can be attained by gluing or nailing a strip of wood the same thickness as the division on to the bearer-board; and as the face of the division will be flush with the front edges of the top and bearer, there will be a small break above and below it, owing to the chamfer. Were this allowed to remain, it would not look well; so the spaces should be filled up with pieces of wood neatly glued in. If the case is either painted or ebonised, the inserted pieces will not be observable; and finished otherwise, they will be almost imperceptible.

THE MANUFACTURE OF TINNED STEEL.

BY CHARLES F. HOWARD.

Of late years great advancement and improvement have been made in the manufacture of tin.

An improved method has been discovered whereby a better class of tin is made by substituting a foundation of steel for the usual one of iron. The advantages of steel over iron are many. Tinned iron requires very careful manipulation in the making up, the grain having to be considered; whereas in tinned steel this need not be looked to, there being no grain.

A few days ago I had an opportunity of visiting one of the largest tin works in Wales. My friend, who had offered to initiate me into some of the mysteries of this special system of tin-making, met me at the gates of the works at 7.10 p.m. The night shift had just started; the timekeeper or watchman not having left his little lodge, after checking them in. We passed in with a "good evening," receiving a "good evening, gentlemen," in return.

We were then in a large yard, and my friend remarked: "I will now show you the process from the very beginning." He pointed out an immense heap of pig iron, which, he said, was their raw material. The pig iron is put into a furnace and worked on by gases, the heat thus obtained being intense.

I approached to within about five yards, when a man, called a puddler, opened a sliding door, and I tried to look in, but I might as well have tried to look into the summer sun. The molten mass was in a white heat. The man laughed when I shrank from the intense glare, and, taking a pair of blue spectacles from his own eyes, handed them to me and bade me look again. With these glasses on I could look well into the furnace, and saw the metal bubbling as if it were water boiling.

From this puddling furnace the metal is run into a gigantic ladle capable of holding six or eight tons. The ladle is supported on a trolley and driven along a railroad by gear, which is worked by hand. The ladle runs over a pit about six feet in depth, where a number of moulds are placed in readiness for the heated metal. The metal is poured from the ladle into these moulds, which form it into ingots or blooms of steel weighing about half a ton each; the process of the puddling and the working of the gases having converted it into steel.

When cold, the steel is taken from the moulds and placed on a trolley running on a very narrow gauge tramway and quickly removed to another shop.

It is then placed in a furnace and heated to a white heat. I was interested to see how they would get this large piece of metal out of the furnace. It was a difficulty soon overcome. Two men with long levers quickly had it out, much as a baker takes his loaves from the oven; a trolley, called a "bogey," being run close to the furnace door, the bloom of steel is levered on to it and conveyed to an immense steam-hammer, a few blows from which soon reduce the steel to a bar about 6 in. by 5 in., which is cut into pieces 2 ft. in length. Two men proceed with one of the pieces, still hot, to the rolling mills, and here it is rolled into a bar 7 in. wide, $\frac{1}{2}$ or $\frac{5}{8}$ in. thick, and perhaps 16 ft. in length. During this process small streams of water are played on the metal, which has by this time assumed a red colour, the action of the water loosening the scale caused by the rolling, and which falls off when the bar is turned over every time it goes through the mill. It is allowed to cool, and then sheared off into lengths suitable to the size and number of sheets required.

It is then carried to another shop, which is fitted up with rolling mills and shears, placed in a line in the centre of the shop, and worked by one engine; and in this department it is rolled by one machine after another, at the last mill being doubled three times, making eight thicknesses. The whole is sheared round the edges, making eight sheets about 2 ft. square, and then placed on a bench, where girls are employed to detach the sheets, which have, consequent on the process of rolling, become tightly pressed together.

The sheets are carefully sorted; if marked or showing the slightest flaw, they are placed aside to be used for purposes other than tinned sheets. The sound sheets, now about the thickness of brown paper, are packed in metal boxes, placed in a slow furnace, and subjected to a steady heat for twelve hours. This is called annealing.

They are afterwards placed in baths of vitriol, this process removing any small pieces of scale, or dirt in any form; and after two immersions in acid and one in water, the sheets are ready to receive their coat of tin.

We have to visit another shop to witness this process, which is one of great interest. A workman taking a sheet of the steel and placing it between two rollers, it is carried downwards into a bath of molten tin. When it reappears, after passing two other rollers, it has the appearance of burnished silver.

However, it is not yet finished. Another workman takes it with a pair of tongs as it comes up and places it between two more rollers, where the process is repeated. After the second dip it is called double-blocked tin. On coming from this it is dipped into a bath of palm oil and then thrown into a heap of sawdust. A girl, whose hands are

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protected with gloves, takes the sheet and rubs off the oil, and passes it to a second heap of sawdust, from which it is taken and placed in a rack. Two girls are now employed polishing them with sheepskin, which is the finishing process of the manufacture.

The result of all this labour is a highly burnished sheet of tin, which only has to be packed to be ready for deliverance to the manufacturers of the best class of tinned ware.

PRACTICAL DETAILS OF BOOKBINDING.

BY GILBERT CLARKSON.

LINING THE BACKS—COVERING—FINISHING—LETTERING.

BEFORE covering a book with leather or cloth, the back must be lined. Leather-bound books should have head-bands glued to the head and tail. Head-bands are manufactured in cotton and silk. For extra bindings, silk should be used, which fills the place once occupied by hand-wrought head-bands. After putting on the head-bands, line the back with good stout paper. Magazine covers can be utilised for this purpose. Proceed thus to line an "open back":—Put the book in the lying press with the back up, glue the back and lay on the paper with the edge about ¼ in. from the left-hand side, bring it over to the right, rub it down with the folder, fold the paper, and bring it over to the left; the ¼ in. of the bare back of the book will be sufficient to hold it; fold it again, and glue the paper already on the back; carry it over to the right again, and cut it off neatly. There will now be one ply of paper fast to the book, and two plies forming the back with an open space between them.

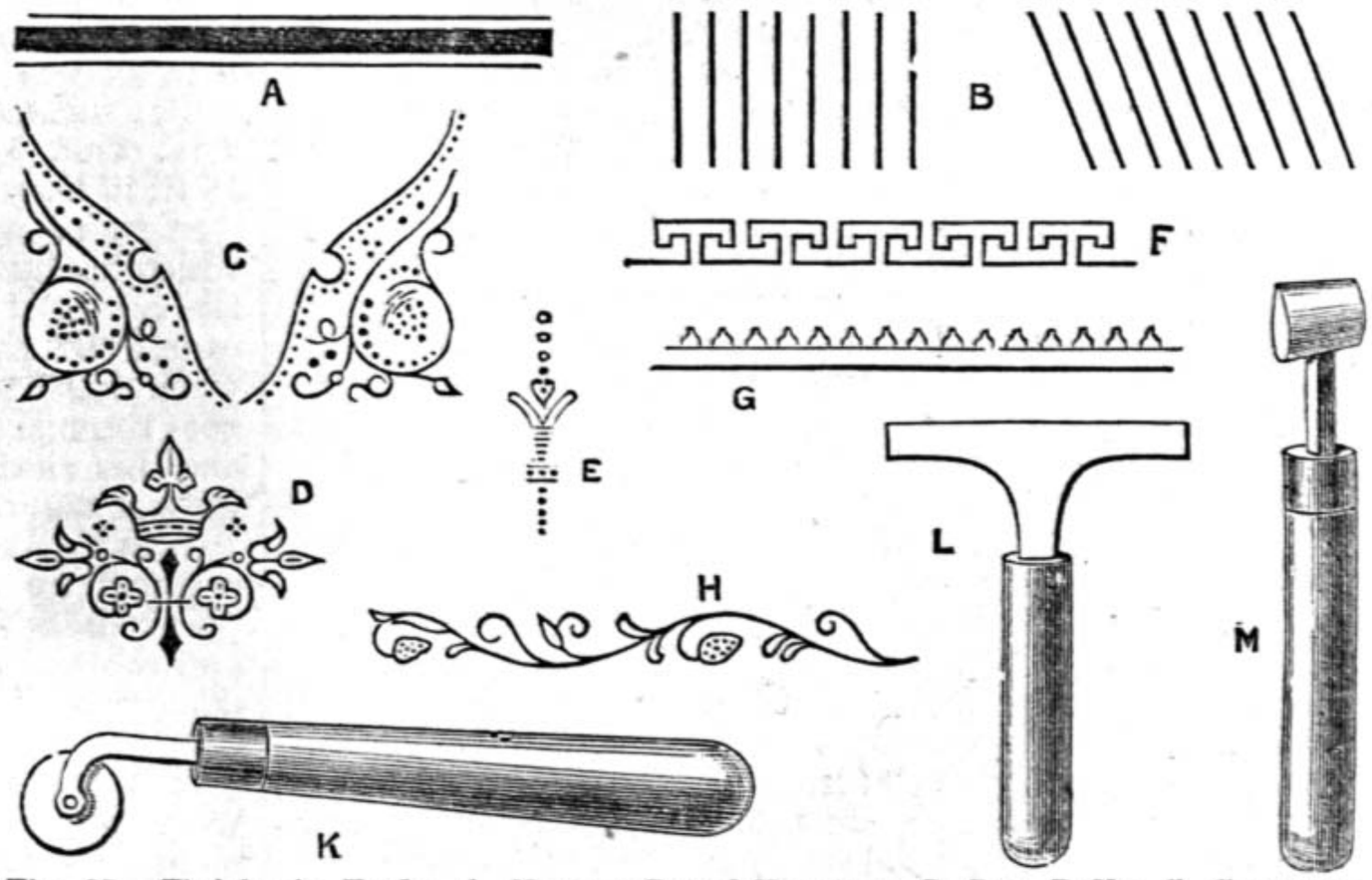

Fig. 25.—Finisher's Tools—A, Narrow-Broad-Narrow; B, Bar Roll; C, Corners; D, Centre; E, Sprig; F, Greek Roll; G, Cat Tooth; H, Roll or Pallet'; K, Roll; L, Pallet; M, Polisher.

A piece of calico or gauze is used for lining cloth books. Cut it broader than the back, so that about 1 in. may come on to each side of the book. Glue the back of the book, put on the cloth and rub well down, glue again, and line with paper from joint to joint.

It is usual to put bands on the back of leather-bound books. They may be flat, round, or bevelled. Flat bands are made with two or three plies of paper glued together and cut into strips. Round bands are simply cord. Bevelled bands are made from scraps of leather glued together and cut narrow at the top and broad at the bottom. Flat bands are best for calf work; the others are more suitable for morocco bindings.

To put on the bands, measure the back into equal compartments, leaving a little more space at the tail. Affix the bands to the compass marks with glue, and when they are dry pare them carefully at the ends with a sharp knife.

The material which is to form the cover of the book, should be cut a little larger than the book to allow for turning in, and pared round the edges. Before pasting calf covers, damp them well on the dressed side of the leather with clear water. Great care must be taken with calf, as it is liable to get stained. Morocco and roan should not be wetted, as it would destroy the grain. The manipulation for all leathers is much the same in every case. The cover is well pasted and drawn on the book as tightly as possible, rubbed down with the hand first, and afterwards with the folder. The head and tail are first turned in, then the fore-edge, the corners cut with the scissors, and afterwards pared with the knife, and set neatly with the thumb-nail. The setting of the heads is very important to the beauty of the binding. A little cap is formed with the leather over the head-band. The double fold of the leather is drawn up a little at this point, and with the folder it is laid down flat over the head-band. The book is put upon its end on the bench, and the folder is rubbed round the back until the leather is nice and square. It is best to give the book a nip at the joint in the lying press between smooth boards. This will ensure the leather sticking to the joint, and at the same time make it smooth and neat.

Half-bound books are treated in the same manner, only, as the term implies, having back and corners of leather. The sides, which may be of paper or cloth, are put on with glue, and when all is dry, the end papers are pasted down and the work finished in the same way as in whole binding. But, as this is part of the "finishing" process, I will leave it for the present.

I have now gone over that part of the science of bookbinding which, in the trade, goes by the term of "forwarding," and have arrived at the finishing stage. I have been trying all through to impress upon my readers, as I passed from stage to stage, the necessity of being careful in the various operations.

Finishing requires not only careful attention in every detail, but a considerable amount of taste and talent; taste to form a true estimate of what will harmonise with the nature of the work and add to the beauty of the binding, and talent to execute the designs in the most complete manner.

In my remarks upon this branch of the art, I will be as brief as possible. I fear that I have already taken up too much space in this valuable journal, which we must remember is not for *a* trade, but for all professions. I will therefore only give a general sketch of the *modus operandi* of finishing, preferring to leave more artistic matters until some future time.

When a finisher gets a book into his hand, the first thing he does is to look it all over with a critical eye, and if he finds any defects in the forwarding he should point them out. Having arranged everything to his satisfaction, he takes his band-stick (a piece of hard wood about 10 in. by 1 in. by ½ in. planed square) and rubs the leather close into the sides of the bands, providing there are bands in the book. This done, he will, if the book is bound in calf, cut a small piece of thin leather of a colour which will harmonise with the colour of the cover of the book, pare it neatly, and paste in the compartment where the title is to appear.

Morocco and roan binding seldom have coloured titles, so they are passed in the operation of "piecing," as it is termed.

The book should next be trimmed, *i.e.*, all divergencies from the straight which have been left by the forwarder in the cover should be pared evenly by the finisher. Backs, corners, sides, and insides, should be treated in this manner, for nothing looks so bad in a finished book as great lumps of leather showing below the cloth or paper of the sides or insides. Continuing the work of preparation for finishing, the board should be opened, one of the end papers torn out (back and front) and laid aside for lining the boards afterwards, and the joints scraped to take away any little pieces of paste or glue that may have lodged there. The end paper which is to be pasted to the board should be trimmed at the sides, so that it will be at equal distances all round from the edge of the board. Attention to these little matters, although they may seem trivial, will go a long way in adding to the beauty of the finished volume.

All leather-bound books are washed with paste-water, *i.e.*, clear water with a little paste mixed in it. This replaces the vellum size used in former days.

Calf, because of its great porosity, requires to be well rubbed with paste before washing. Paste the back with the brush, and rub the paste well into the leather with the folder, taking care not to rub *too* hard. Sometimes a little oxalic acid is added to the paste-water, which helps to clear the lighter colours of leather. The workman will have to use discretion in this matter, as the acid will destroy some colours.

When the books have become thoroughly dry after washing, the parts where the gilding is to be applied are glaired. Glaire is the whites of eggs beaten up until they have become as thin as water. Most leathers require two coats of glaire; the first must be allowed to dry before the second is applied. Cloth is only glaired once.

There is a preparation called albumen, which I do not like, taking the place of glaire. It does well enough for blocking cloth work, but for finishing leather, especially extra work, it is best to use glaire that has once been fresh hen eggs. When both coats of glaire have become perfectly dry, the gold is cut on the cushion and lifted with cotton wool and laid on

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where required. For laying on calf, hog's lard is used (a little bit on cotton wool rubbed gently over the glaired parts); for morocco, roan, and cloth, olive oil is used. Both oil and lard should be used sparingly, for they are likely to leave a nasty stain which nothing will remove. The tools, which are of brass, with wooden handles, are placed upon a gas-stove and heated to the proper degree of heat, when they are taken up one by one and impressed upon the top of the gold. The heat causes the gold to adhere, and the impression of the tool, whether it be a line or a flower, is left upon the cover. (Fig. 25.)

Lettering is executed in the same manner. After the tooling is completed, the surplus gold is wiped off with a cloth, called the "gold rag," kept for this purpose alone. Any particles of gold still adhering to the leather are cleaned off with indiarubber. Calf is polished, after lettering and tooling, on the glaired parts. The portion of the cover which has not been gilded is washed with clear water, which removes any glaire or finger-marks which may have got on while the operation of gilding was being proceeded with, and blind-tooled according to style or fancy.

At this point, the sides are put on for half-bound books. The inside of the board is lined with the end paper laid aside for that purpose. The other end paper is pasted to the board; care should be taken to make it stick at the joint. The boards are left open to dry. When sufficiently dry, the boards are closed, and if the book has marble edges, they are burnished with a tooth-shaped burnisher. A sheet of tin or zinc is placed inside and outside each board, and the book placed in the standing press, and the press screwed up more or less tightly, calf allowing of more pressure than morocco. Instead of tins for the outside of morocco books, boards covered with flannel are used to preserve the grain of the leather. When the books are taken out of the press they are polished up and looked over for any defects or finger-marks, which on being put right, the finishing touch is given with the brush, and the book is handed over to the foreman for inspection.

As I have already stated, I have only given a general idea of finishing, and I have not touched upon blocking.

These matters, taken by themselves, are quite sufficient for a series of articles. There is so much that is artistic in finishing, not only in tooling beautiful designs upon the covers, but also in the various methods of enhancing the leather — such as colouring, sprinkling, marbling, tree marbling, gold marbling, transferring landscapes, inlaying, and many other operations—the mere mention of which would make an article sufficiently long for these pages.

I here give three designs for hand-tooled morroco work in Figs. 26, 27, and 28. They are not *the* best which I have in my collection. I selected them because they were comparatively easy for me to copy with the pencil from the rubbings.

We are very jealous of our rubbings, and like to keep them in a safe place.

In taking leave of letter-press binding, I would like to say that I will endeavour to prepare another series of articles on "Finishing and Blocking" if a place can be found for them. In the meantime, any question sent to me will be carefully considered and answered in "Shop."

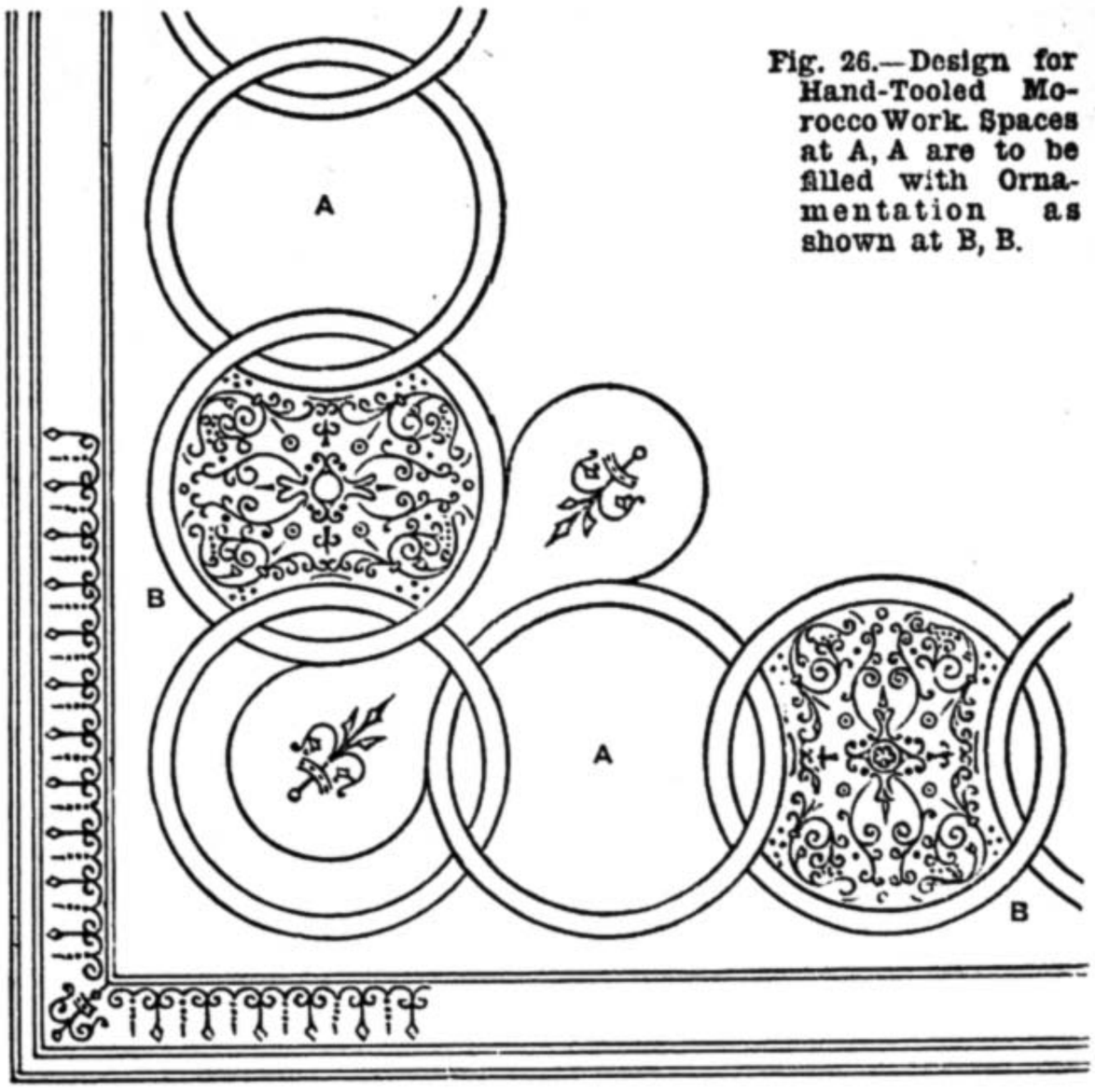

Fig. 26.—Design for Hand-Tooled Morocco Work. Spaces at A, A are to be filled with Ornamentation as shown at B, B.

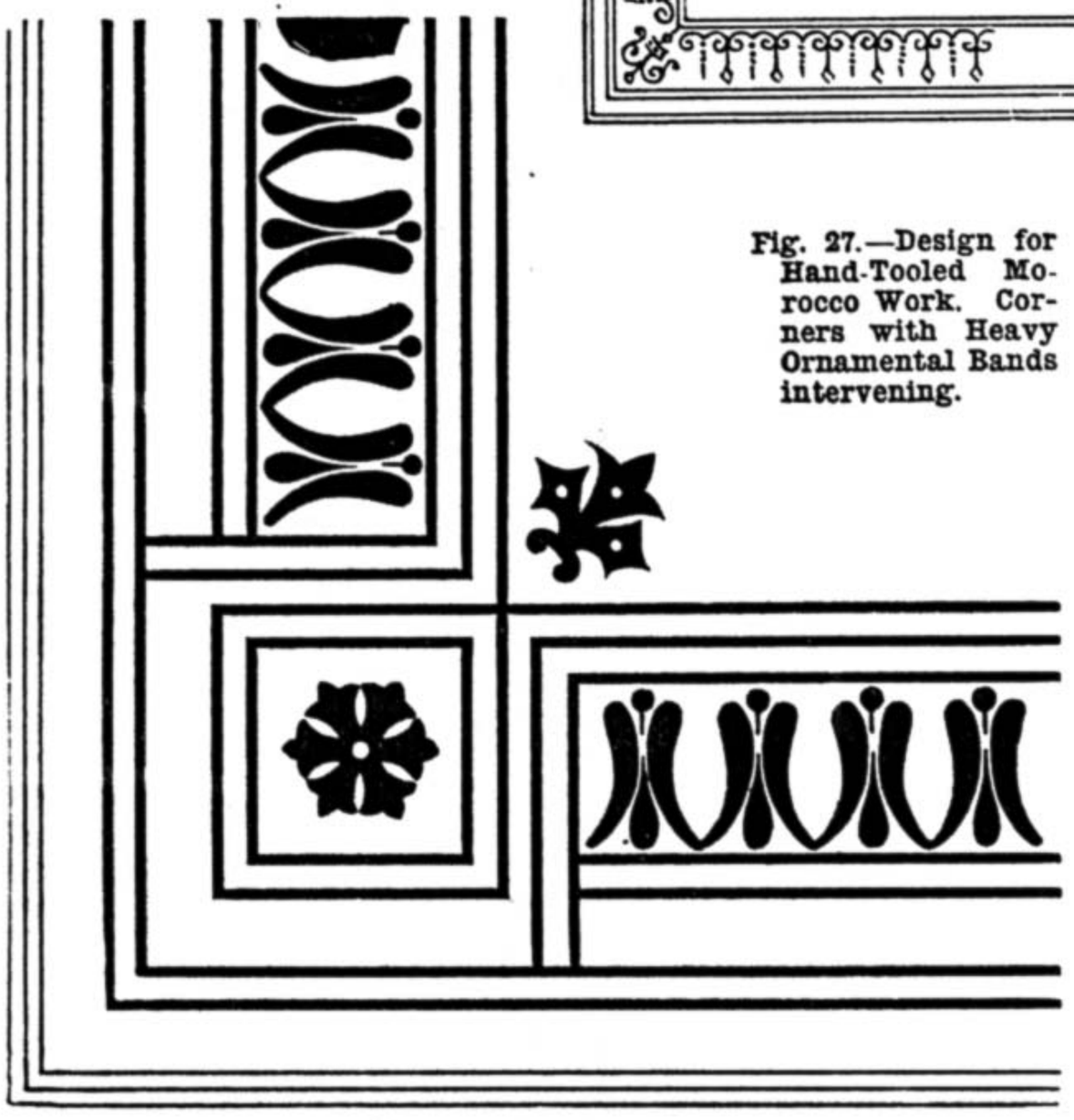

Fig. 27.—Design for Hand-Tooled Morocco Work. Corners with Heavy Ornamental Bands intervening.

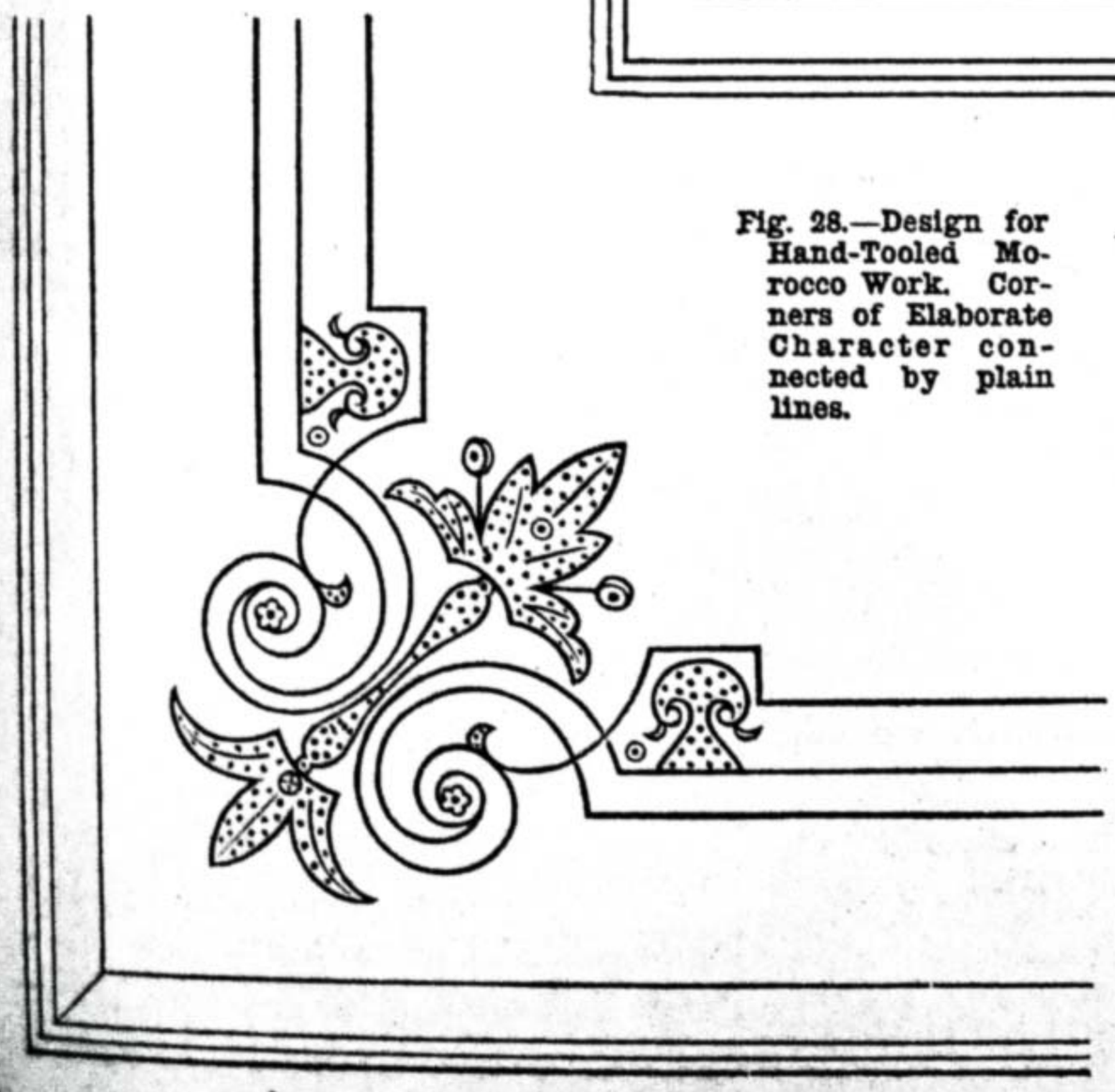

Fig. 28.—Design for Hand-Tooled Morocco Work. Corners of Elaborate Character connected by plain lines.

SAFETY GUN-SLING HOOK.

BY THE INVENTOR, JOHN C. KING.

With the present shooting season we may expect the usual numerous gun accidents to bring sorrow to families as it has done so recurrently ever since guns were invented. These catastrophes may be averted in the matter of carrying loaded guns when getting over fences, or carrying them when not beating for game, and certainly enable better shooting by the hand not being fatigued by bearing the weight of the gun.

As the contrivance is quite simple, and cheaply made by any person handy with common small tools, the illustration may be a guide to the manner of making, aided by a statement of a few details.

Two straps and a hip-strap with hook constitute the outfit. A belt for the waist is one strap, and a cross-belt the other. Cloak straps will serve, and for the cross-belt is the right thing, as this belt should be light, and fit loosely over the left shoulder across the breast and back, down to the waist-belt, at the hip-strap on the right side; which hip-strap may be hung on the waist-belt here, or on to the cross-belt, dispensing with a waist-belt altogether. In this way I have carried guns climbing steep ground or descending difficult gaps, and have often gone up and down ladders, having both hands free; in fact, I have climbed trees with the gun thus hung to me.

In use, at times, I forgot that I was the bearer of a gun: it rides so lightly, and out

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of the way, with the stock by your right hip, and the barrel at your back, the muzzle pointing up from the left shoulder.

For horseback it is safe and handy; at all paces and jumps, here the waist-belt is useful, though not indispensable. As the whole merit of the contrivance is in the hook and its shape, to prevent the gun from jumping up and getting released from the hook, its illustration will explain it and the knack of lifting the gun off the "hook" where it hangs by the trigger-guard—or any such loop; if without a trigger-guard—is soon acquired by the sportsman. The illustration affords a sketch, half full size, of the hook as riveted on to the hip-strap. This strap is folded double, so as to hold it on to the cross-belt.

It will be asserted, and admitted, that a hook has been used to carry a gun, but the hook to be effective must have a special form: this is shown at the projection at A, which prevents the gun being tipped, dragged, or jolted off the hook at B. The only release is by placing the thumb of the right hand on the top of the hook C, at the same time as the gun is grasped by the fingers at the neck of the stock, and turned so that the trigger bow or hoop is lifted clear of the projection A. This can be done in an instant, walking, running, or at a gallop on horseback.

Safety Gun-Sling Hook: side view.

The barrel of the gun is simply retained by the loose cross-belt as it rests against the sportsman's back, so that in the release from the cross-belt, the arm that holds the gun after its release from the hook has only to be dropped straight down by the side, and the gun comes from under the cross-belt ready for raising to the shoulder with one hand's use only.

Having carried rifles and carbines in all the many various ways adopted from time to time in the service, and knowing some to be awkward, I confidently recommend this plan for sporting guns.

How about the trigger touching the under side of the hook? will be asked. The trigger-guard is too wide to rise up on the hook to allow the trigger to touch the hook; the dotted lines D represent a section of the guard which the contraction of the hook at A prevents the guard rising.

Where can they be bought? will be one of the earliest questions. There are none made for sale. A pattern one—the hip-strap and hook—is at the service of any one disposed to make one themselves, or have one made. As in these matters all particulars are serviceable, and those who use guns are mostly more or less expert in metal working and strap cutting, the way to make is now detailed. The cloak-strap you can buy. The hook pattern you take to any brass or nickel foundry; or to make sure of the work being right, to a brass-finisher of the right sort, as Mr. Faultless, the Plater, Great St. Andrew's Street, Seven Dials, S.W. He will supply you in the rough from your own pattern, or he will finish it for you; and as he is a leather worker as well, he will mount it on the hip-strap as it should be mounted if wished, or any other harness plater would do it. In most towns there are several of these shops to be found.

In making presents to gentlemen, ladies are often uncertain what to select: slippers, cigar-cases, etc., have been hard run as presents; but a "safety gun-sling hook" would be a distinctly useful thing, and perhaps might be the means of saving the life of a brother, father, or friend, if given to one or other of them, and used by them.

One of the hooks that has seen many years hard service is at the office of WORK, and patterns may be freely taken from it by anyone applying to the Editor if the illustration is not sufficiently clear.

A CANVAS CANOE.

BY J. B. FERGUSON.

As directions for building canoes in wood have been given in WORK, perhaps some of its readers may like to learn how to make a canvas canoe. I have made seven or eight of the kind I am about to describe for myself and several of my friends. They were all made of a light framework of yellow pine, covered with stout calico, which was made watertight with linseed oil and paint.

A canoe of this description offers many advantages over a wooden canoe. It is very easily made by an amateur, requires very few tools, and will not take so long to make as a wooden one, will cost much less, and, what is of great importance in a canoe, is very light, and can be easily lifted about by one person, whereas a wooden canoe would require three or four. They are very durable; one I have now has been in use for three seasons. A canoe is different from a boat, being taken out of the water when not in use, and kept under shelter. If a hole does get knocked in it, it can be easily patched. All the wood is put together with screws, so that, if necessary, they can be unscrewed and covered again with calico. In any case, I think it very desirable that amateurs should attempt this kind of canoe before making a wooden one, and, if he fails, he will not have wasted so much money as he would have spent in making a wooden one.

The drawings had better be explained first. Fig. 1 gives the elevation of the canoe, showing the distance apart of the ribs—viz., one foot centre to centre and two feet from the bow and stern. Fig. 2 shows the plan looking down upon the canoe. The widths are all here shown. The inner line is the curve the canoe would assume if cut through at the dotted line shown in Fig. 1. Fig. 3 shows the method of fixing the stem and stern-post (which are both alike) to the keel. The fillet (B S) at the back is screwed to the posts, and forms rebates, into which the ribands fit on each side. The ribands are not shown, but it will be understood that they run from bow to stern, and are screwed to the ribs. At the bow and stern the gunwale is on a level with the deck piece, and screwed to it, as shown in Fig. 11; and the deck pieces (D P) and other gunwale (G) at this point are 12 in. above the top of the keel, but in the centre of the canoe (Figs. 4 and 7) it is only 9 in. This makes the bow and stern of the canoe higher than the centre body, and is known as the sheer. In this case, the sheer at bow and stern is made, for simplicity, the same, but the bow generally has the most sheer. Figs. 4, 5, 6, 7, 8, and 9 show the shape of the ribs (R) after being steamed; also the position of the ribands, R N S, gunwale, and the height of it at the different points. Fig. 10 is a section of the stem or stern-post (S) and the back post (B S), showing the method of fixing the ribands. Fig. 11 shows how to fix the gunwale to the deck piece. The remaining figure shows the shape and size of the paddle.

The materials used were:—Elm for the ribs, ash for the stem and stern-post. The rest of the wood was yellow pine. All the wood was joined together with brass screws, of a size suited to the wood they have to unite. The whole of the framework is covered with unbleached calico. The materials I used were all of the very best kind, and the cost was under 25s., and, with care, would cost only 18s. or 20s.

The amateur, before starting, should carefully examine the drawings, and get to thoroughly understand them. I will now describe how to proceed making the canoe.

The keel is to be prepared first: See that it is perfectly straight. Cut it 12 ft. long, $\frac{7}{8}$ in. thick, 2 in. deep, and plane smooth. Then taper the ends to $\frac{3}{4}$ in. thick and $1\frac{1}{2}$ in. deep, so as to fit the stem and stern-post. (See Fig. 3.) Next bevel the keel both sides, so that it is $\frac{7}{8}$ in. at the upper surface and $\frac{1}{2}$ in. at the under. (See Fig. 4.) Then cut 4 in. rebates at the end (Fig. 3).

The stem and stern-posts are now to be cut 2 in. wide to the curve shown, out of a $\frac{3}{4}$ in. ash board, then planed so as to be $\frac{5}{8}$ in. thick on the front edge. Corresponding rebates may now be cut in the end to fit those in the keel. The stem and stern-post and keel may now be screwed together, after testing the joint and seeing that they are all in one plane, otherwise your work will be out of truth. The joint should be painted with white lead before screwing, so as to be watertight.

The false keel may now be prepared. Cut it 12 ft. 8 in. long, $\frac{7}{8}$ in. wide, and $\frac{1}{2}$ in. deep. Then cut notches on its upper surface $\frac{1}{4}$ in. deep and $\frac{3}{8}$ in. wide, into which the ribs about to be described are to be screwed, from the under surface. There are eleven notches to be cut (Fig. 2), the middle one in the centre of the keel, and the others 1 ft. centre to centre from this one.

At this point you should prepare for steaming the ribs, to give the canoe the proper shape. Cut out the shape for your moulds full size on paper exactly as shown in the Figs. 4 to 9. The best way to get those shapes would be as follows:—Take Fig. 4 for example. Draw a centre line, and then two lines at right angles to this, and 9 in. apart. The upper one will be the gunwale edge, and the lower the top of the keel. Then mark off on each side of the keel 1 ft. 1 in. for the width of the canoe, and draw a curve the same as that shown, and then mark it on a flat surface, such as a boarded floor. Next draw a line parallel to this $\frac{3}{4}$ in. from it—viz., $\frac{1}{4}$ in. for the ribands and $\frac{1}{2}$ in. for the ribs. Now cut pieces of wood $\frac{1}{2}$ in. thick and to go along the inner line. Treat all your other sections the same as you have done this. You will also require another mould for the back post to the stem and stern. This curve will follow that at the back of the stem and stern.

Having laid down your moulds, you will next require about fourteen strips of elm, $\frac{3}{8}$ in. by $\frac{1}{2}$ in. Get an iron pipe, and plug up one end, fill this with water, and put it over the fire, with the ribs inside, to steam —or, more correctly, to boil—and stop up the other end with a rag. After they have

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been steaming for two or three hours, take them out quickly, and, while you bend them closely round the mould, get a friend to drive temporary nails to keep them in position. Allow them to remain thus for a few days. Before removing them from the mould, mark where the centre line comes, so that you will know where to screw them; and also mark where the upper point of the gunwales comes to. They may now be taken off, but tie their ends with string to keep them in position. You will find that you will require two of each ribs, except No. 6, which is the centre rib. Fig. 1 will explain this.

You may now screw the ribs to the false keel by screwing from the under side of the keel and letting the ribs rest in the notches before mentioned. Take particular care that you place the right ribs in the proper place for it. It would be advisable to ticket them as they leave the mould, and place corresponding marks on the false keel. Then lay the false keel upon the keel, and bore holes with the bradawl between each division of the ribs. Now remove the false keel. Take your calico now, and lay its centre line along the keel, stretching it from end to end, not *too* tightly, and tack with ½ in. copper tacks at the ends. Then tack round the holes made in the keel at the top, to make it watertight. Now lay down your false keel, and screw through the holes already made with 1¾ in. brass screws. The calico I used was unbleached, 40 in. wide. It took about 7½ yards, double width, at about 1s. 3d. per yard. Before stretching the calico on the canoe, it is a good plan to wring it out in water and let it dry.

The gunwale may now be prepared. Let it be about 16 ft. long and 1 in. by ¼ in., and screw it to the rebate made for it in the upper part of the ribs. Now cut out of a piece of ¾ in. wood the shape shown in Figs. 7 and 8, and fix them in position where shown in plan—viz., at shape 4 and 7. These pieces form the front and back of the well respectively.

At this point you had better stretch a piece of string tightly from bow to stern, to see that you work true, and take care that the centre of the front and back of the canoe come on this string.

The deck pieces have now to be put in: they are 1½ in. by ¾ in. Screw the front deck piece to the bow or stern-post and the front of well, and the back deck piece to the stern-post and the back of the well, taking care that you have fixed the proper height for it on the posts.

The back posts (Fig. 3) may be screwed to stem and stern, letting them reach up to the under side of the deck piece, so as to form a rest for it. After the deck pieces are placed in position, the gunwale may be cut and screwed to the deck piece. (Fig. 11.) The gunwales should be both placed into position together and marked for cutting, because it will be found that, if they are done separately, it will put your work out of centre. It will thus be seen that, if your work is not true before fixing the gunwales, they should be made to get it so.

The ribands will be the next consideration. These should be nearly 16 in. long and ½ in. by ¼ in. thick, planed smooth, and take the sharp-edge off their outer sides with sand-paper, so that it will not cut the calico. The same remark applies to the gunwale and the upper part of the deck piece.

To get the positions of your ribands, divide the distance on each rib from the under side of the gunwale to the keel. The centre will be the point for your third rib. Then place the other four at equal distances on each side of this one. Screw the ribands to the ribs with ½ in. brass thin screws. I ought here to say that all screws should be well countersunk, so as to prevent them making holes in the calico. The ends of the ribands where they fit into the stem and stern-post will require to be thinned a little, so as to make a neat joint.

The framing for the well-hole is next put together, ¾ in. and 2½ in. deep. (Figs. 7 and 8.) The ends of the side pieces to the well are prolonged so as to rest upon the back and front of the well. (Figs. 1 and 2.) Fit the pieces in position, but don't screw up.

The whole of the work should now be sand-papered, dusted, and given two coats of good oil paint. While the paint is drying, you may prepare your paddle. Let this be of light yellow pine. The chief thing in a paddle is that it should be as light as possible. In the end of the paddle stick, which is 6 ft. long, cut a slot 6 in. by ¼ in. to receive the blades; then cut your paddle to an oval shape of 1½ in. by 1¼ in. at the middle, tapering to 1⅛ in. by ⅞ in. to within about 8½ in. of the end. The stick should have its full thickness at 6 in. from the end of the slot, and be tapered a little along towards the ends. Cut the blades out of ¼ in. stuff, and plane them to ⅛ in. at the edges, and then screw them into position with three screws at each end.

If you think it can bear it, the paddle may be made lighter than this. It is liable to give at the ends of the slots, and a piece of copper wire may with advantage be twisted round at the point.

The paddle may be sized and varnished, except about 1 ft. 3 in. on each side of the centre, where you will grasp it. This part should be merely oiled.

A rest for the back will be required next. Get two strips ½ in. by 3 in. wide, and 1 ft. 6 in. long, and join them with two ledges, allowing a space of about 2 in. for the spine to fit into. You should also prepare the floor board, ¼ in. thick, but don't fix it until the calico is tacked on. When the paint is dry, you can prepare to stretch your calico. After laying it on, you should have tied it neatly to the keel, to keep it clean. Commence at the centre of the canoe, and stretch it tightly, pulling towards the gunwale and along the ends, doing this at intervals of about every 9 in. or 12 in., leaving about 18 in. of the bow and stern untacked until you have finished tacking it to the stem and stern-post. Now go back along the gunwale and tack about 1 in. apart until you get all the wrinkles out, driving your tacks into the top of the gunwale. Great care should be taken in tacking to the stem and stern-posts so as to get the joint watertight. Cut the calico approximate to the shape and pull it towards the ends, and turn it inwards, so as to get a good edge outside, tacking at intervals of about 4 in., and, if done to your satisfaction, tack at much closer intervals, placing the tacks almost side by side. Before putting on the top, you had better paint the joint on the inside, so as to fill up any small hole unnoticed.

The calico for the ends may now be put on. Cut it roughly to the shape, and tack temporals around, stretching tightly, and pulling all wrinkles out. Finish by tacking about 1 in. or so apart. The calico should be tacked to the front and back of the well on the inside.

You may now screw your floor board down. Make this very secure, as it will strengthen the ribs very much, and keep them stiff.

To the under side of the side framing of the well tack strips of calico, stretching tightly; then place your framing in position, and screw it down. Also place pieces of wood (two on each side will be sufficient) from the under side of the framing to the gunwale, so as to stiffen the well. You may now finish tacking the calico to the gunwale along the sides of the well. I hope I have made it clear how to stretch the calico. It is very difficult to describe, but the thing to be aimed at is to get all wrinkles out, and this is best done by tacking temporarily first and then going over again and completing it.

You may now give the calico a coat of raw linseed oil. Don't apply it with a brush, but rub it in with a flannel. After this is dry, give it another coat of the same, and then paint it to your taste. Some use boiled oil instead of raw. This dries much quicker, but some think it makes the calico stiff and liable to crack.

To two canoes that I made I gave a priming coat, and then painted them a light yellow with a coat of varnish, which I thought looked very nice. An apron will be required to go over your legs while paddling. It may be made water-proof with oil.

Great care should be taken that no dirt gets inside the canoe, as it is apt to get between the ribands and the calico and wear holes. A very good plan would be to enclose the well all round with calico, and then, in case of an upset, you would be much safer.

The canoe I have at present I keep in a box, with a covering over the canoe to keep out the dust; but a box is not absolutely necessary if you could put it in a yard near the water. In that case, a covering would be quite sufficient to keep out the dust.

They are very good sea-boats, and not by any means the dangerous things people think them. I am living at Swansea, and have often been to the Mumbles about five miles along the coast, and visited Oxwich and other places in them. A large amount of baggage can be carried on board, which would be put either in front or behind.

The amateur need not be afraid at any apparent difficulty in making them. If he will proceed in the order I have described he will find everything simple, and will be rewarded by having a very good sea boat, and I wish him much pleasure in "paddling his own canoe."

As autumn has now fairly commenced, and amateur workmen are now forsaking outdoor amusements of all kinds and returning to their workshops, the time seems to be well fitting for descriptions of such articles as a "Canvas Canoe." It has been given now that no one who is fond of the water and aspires to be his own boat builder may complain that sufficient time has not been given him to build and equip his boat before the genial spring gives him another opportunity of taking his pleasure on sea or river. The diagrams, in all probability, will be thought small by many readers. That they are so it is impossible to deny, but against this it may be urged that they are so clear and definite that there will be no difficulty in enlarging them to full-size working drawings, especially as dimensions are given as a guide to the draughtsman. And with these concluding remarks, I will leave the reader to the work of building if he choose to undertake it.

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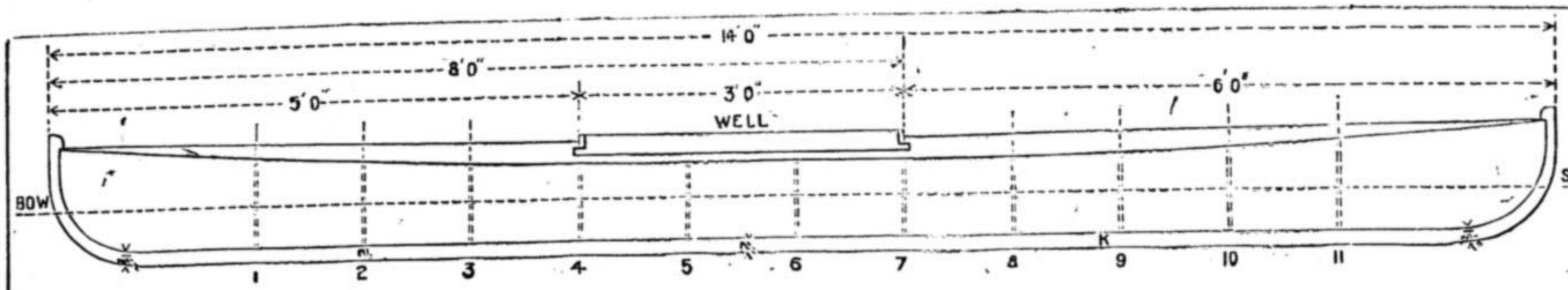

Fig. 1.—Elevation of Canvas Canoe.

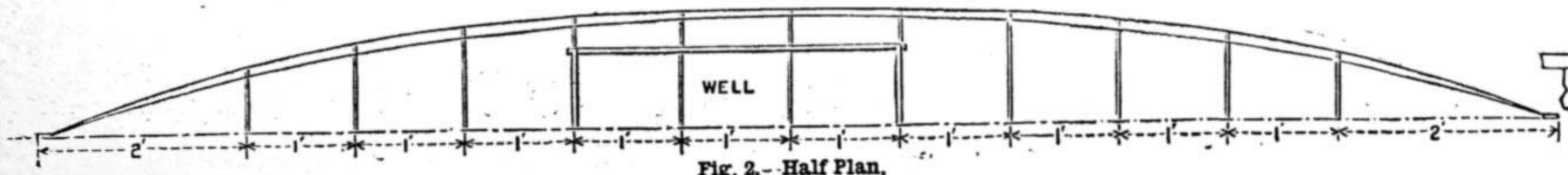

Fig. 2.—Half Plan.

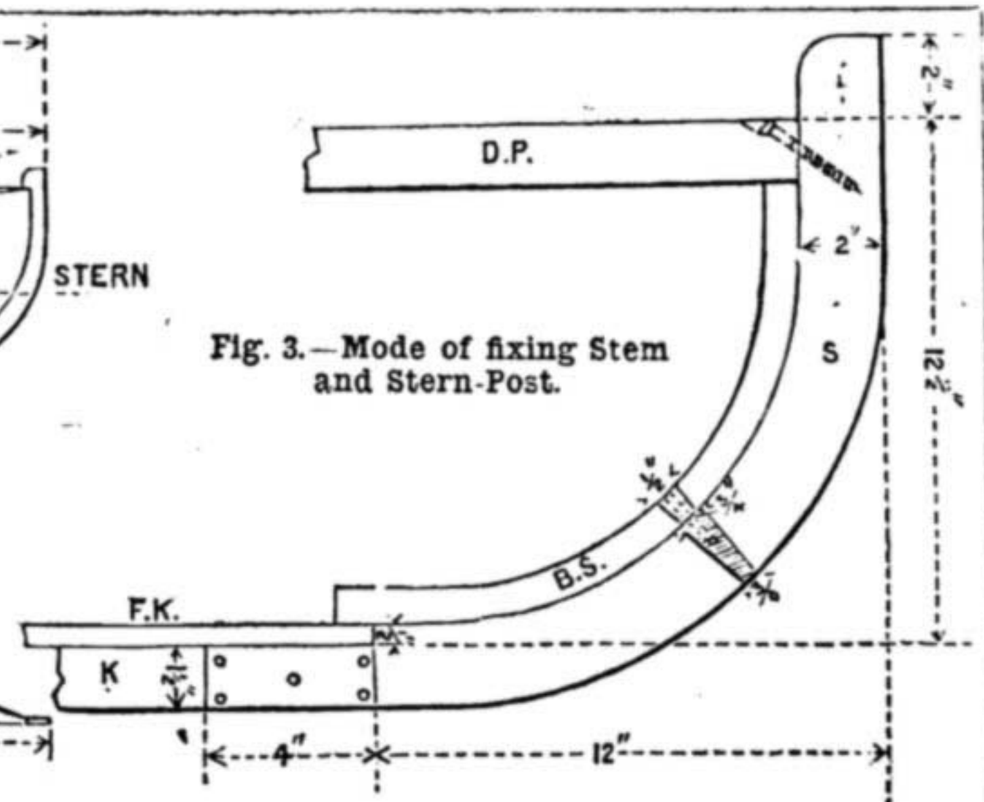

Fig. 3.—Mode of fixing Stem and Stern-Post.

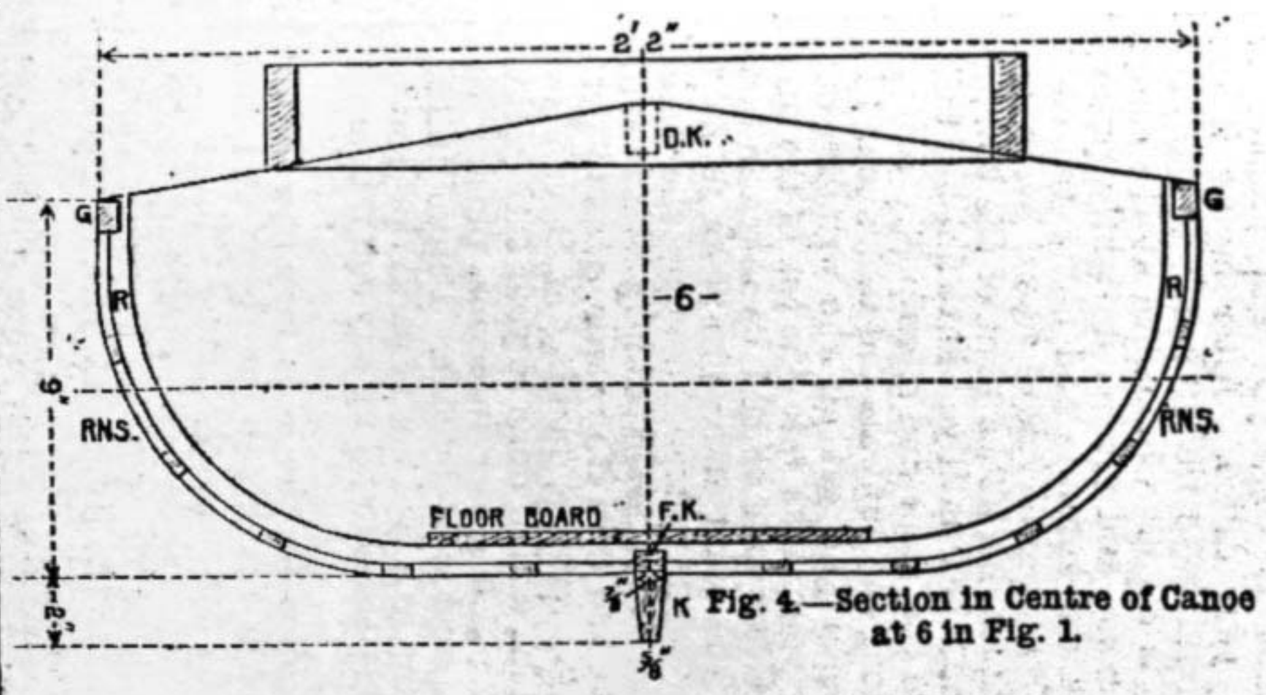

Fig. 4.—Section in Centre of Canoe at 6 in Fig. 1.

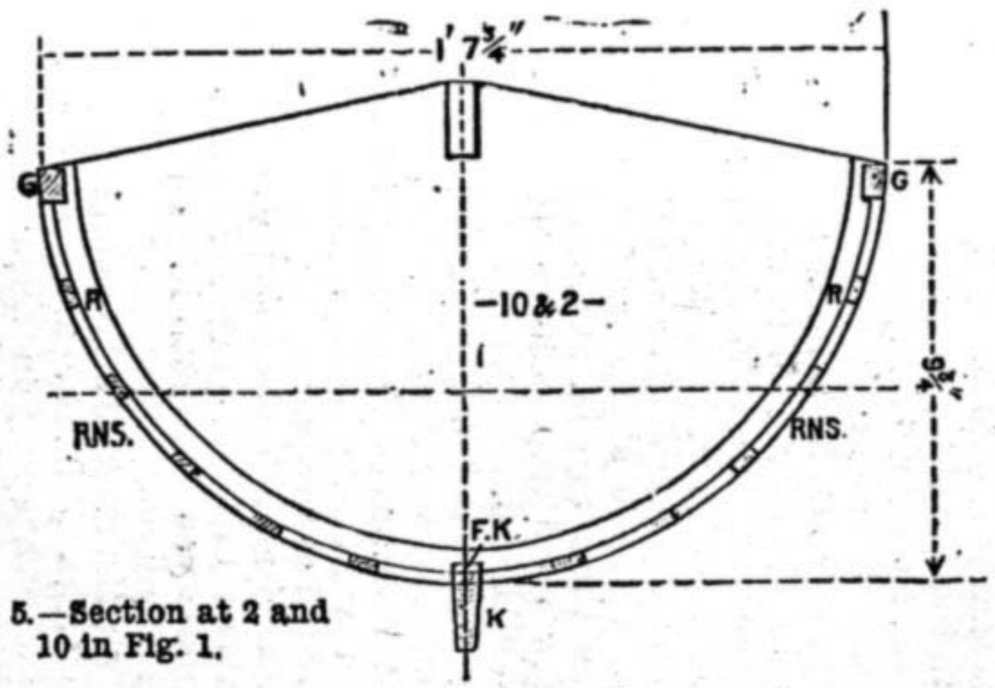

Fig. 5.—Section at 2 and 10 in Fig. 1.

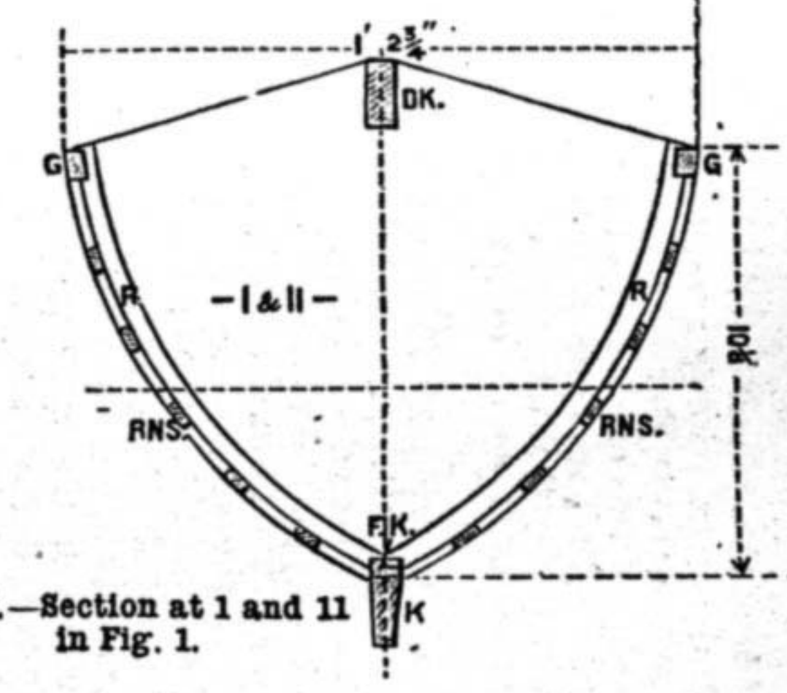

Fig. 6.—Section at 1 and 11 in Fig. 1.

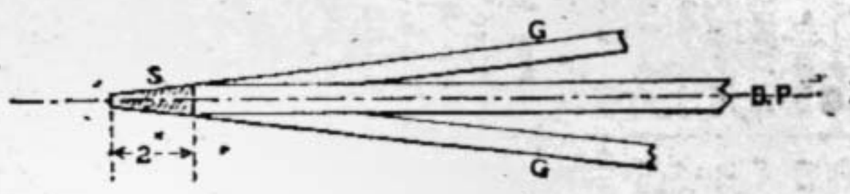

Fig. 11.—Mode of fixing Gunwale to Deck Piece.

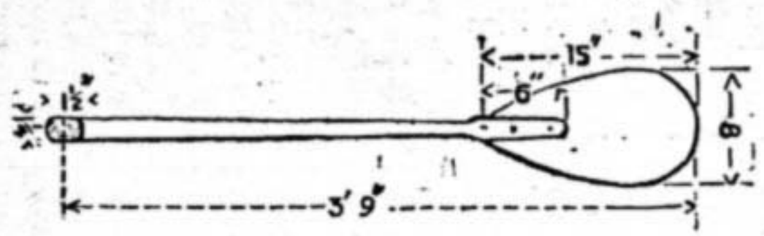

Fig. 12.—Diagram of Paddle.

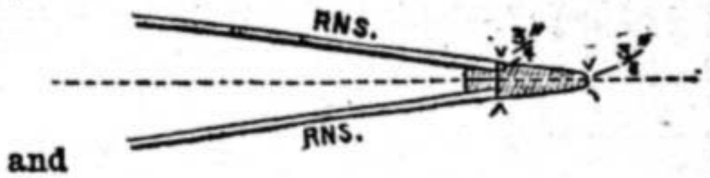

Fig. 10.—Section of Stem and Stern-Post, and Back Post.

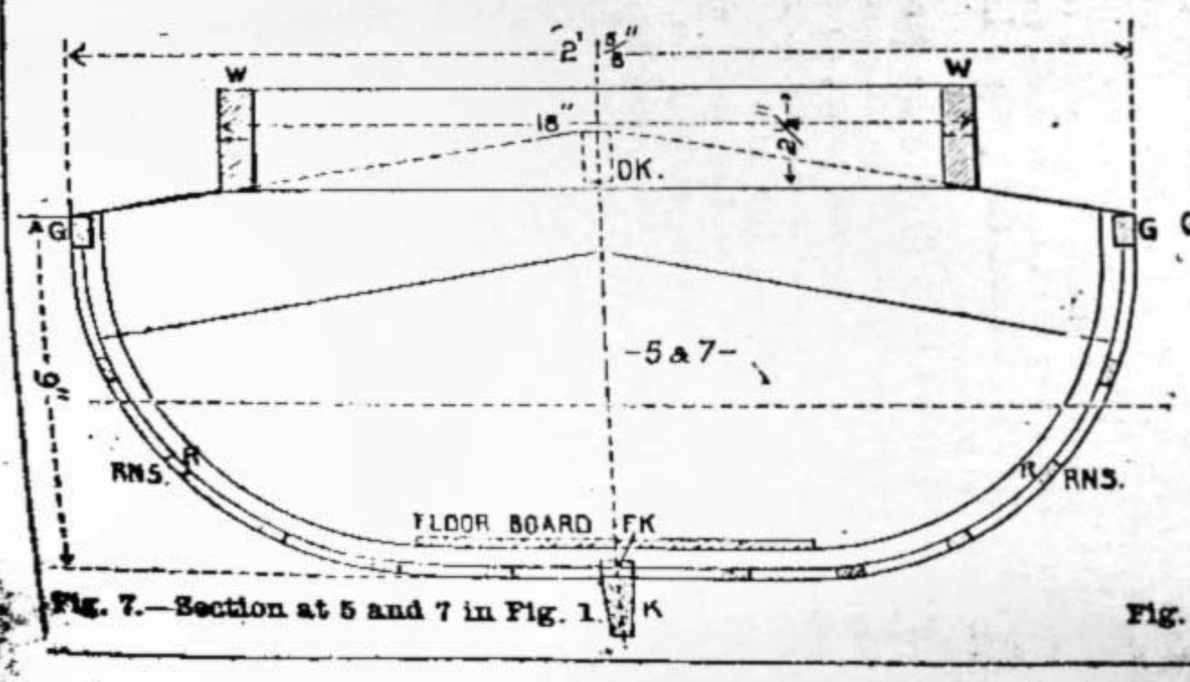

Fig. 7.—Section at 5 and 7 in Fig. 1.

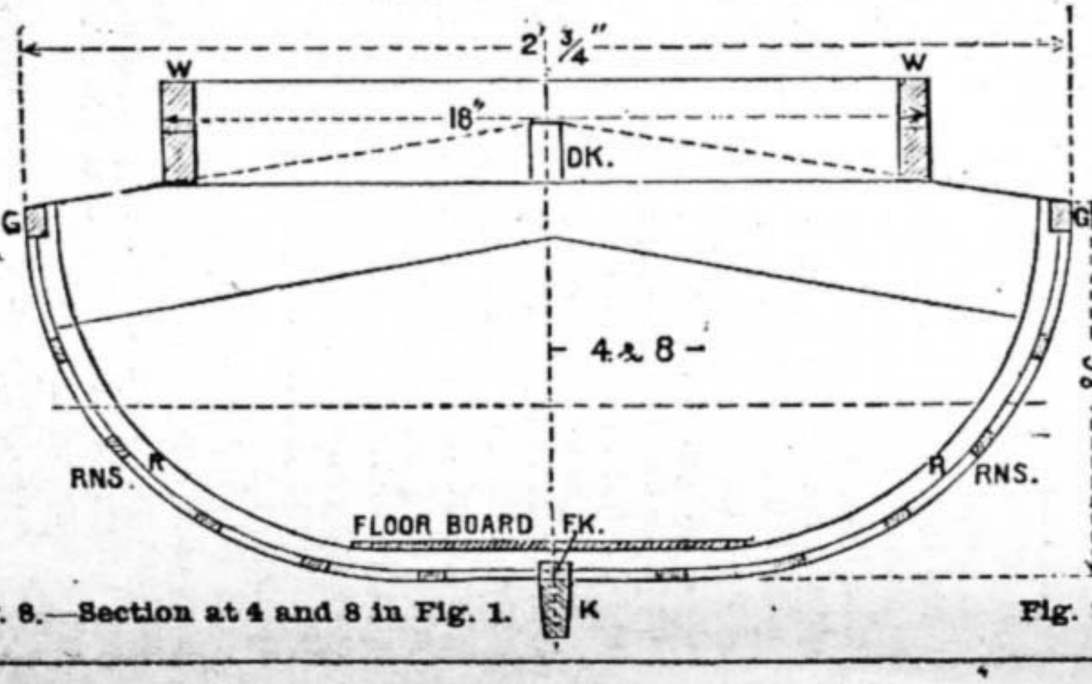

Fig. 8.—Section at 4 and 8 in Fig. 1.

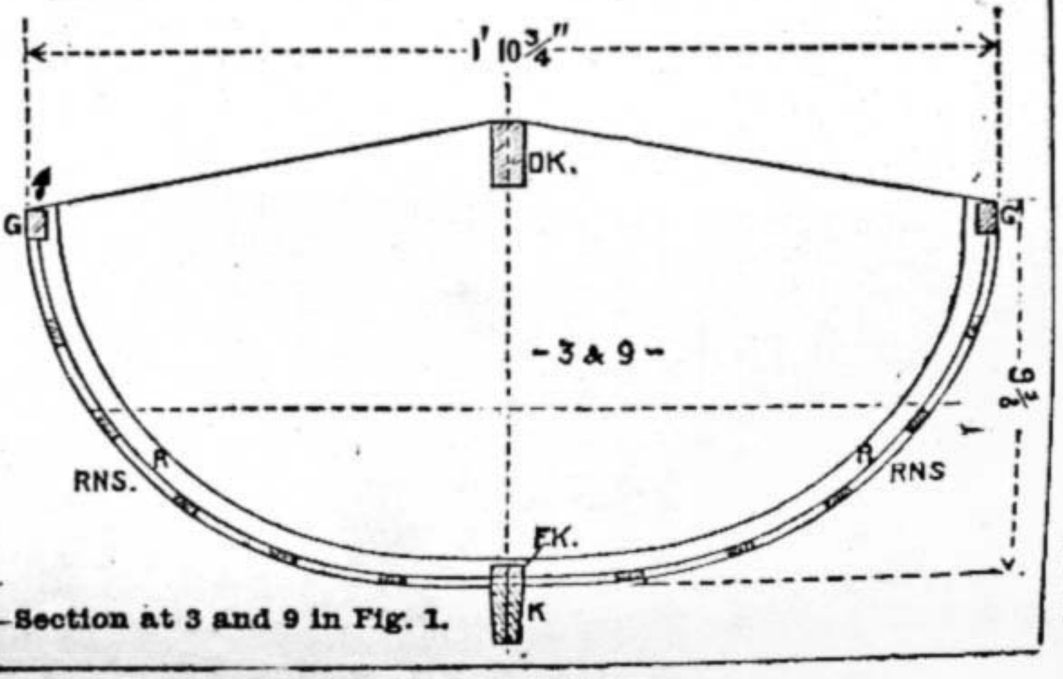

Fig. 9.—Section at 3 and 9 in Fig. 1.

[Work—September 27, 1890.

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HOW TO MAKE A PAINTER'S EASEL.

BY D. DENNING.

It would be a strange thing if among the thousands of readers of WORK there were not some whose artistic instinct impels them to paint pictures—I had almost said works of art; but those who make these are hardly likely to wish for directions how to make an easel. No; those to whom the following hints are likely to be useful, are those who wish to do a bit of canvas-daubing—or, may be, paper-staining—to beguile themselves during their leisure hours, and, perhaps—who knows?—in future years become the leaders of picturesque art. Well, if any readers are ambitious enough to aspire to seeing the magic letters R.A., or even A.R.A., after their names, they will be none the less likely from the fact that they made their first easel themselves. Still, I must confess that I hope a great many more young artists than are ever likely to join the forty will be inclined to make their own easels.

That these indispensable articles of the studio vary in construction very considerably is, of course, understood; and, possibly, the easel shown in the illustration (Fig. 1) may not seem half complicated enough to suit the taste of those who do not care for simple appliances, but would prefer to make something more difficult. May I just suggest that their opportunity will come by-and-by, when they get the canvas in hand, and meantime ask them to remember that a good picture may be made on a very commonplace easel? *Apropos* of this, I was much struck one day last summer when accompanying my friend Peter Ghent, the Conway Valley artist, whose "counterfeit presentments" of whitewashed cottages glow with the dazzle of summer sunlight, to notice the simplicity of his sketching easel. Of this, by the way, I made a sketch and took particulars, for the benefit of readers who want a good, light easel for out-of-door work. Just now, however, what I want to say is this: If a man like the aforesaid P. G. uses a common, rough little easel, there is no reason why the one now described should be blamed if the work done on it is not quite up to Royal Academy excellence. Not that this is always very high. Perhaps some inquisitive individual may want to know why I describe this easel in preference to the one just referred to. If so, let me say that I have a liking for this one. It stands by me as an old friend; so old that, after raising my pen to consider how many years I have had it, I am almost afraid to say. It almost takes one back into ancient history. I think it was made in the year of the "Seven Days' War," but it is as sound as ever, and much more handsome in appearance, for has it not been honoured with a coat of enamel paint, which hides its, till lately, somewhat dirty surface? It is, in fact, promoted to the dignity of a drawing-room easel, whereon stands a picture completed and framed, with just a little bit of cunningly arranged drapery to hide its nakedness. But why mention this? For no other reason than to suggest to those who don't want to make an easel to paint on that they may make one to serve as a stand to fill up an odd corner and support a picture. By altering sizes, even a small table easel, or one to hold a photograph, may be made in the same manner as the one described. Nor is there any necessity why the humble pine must be used for such a fancy article. For use as a painter's easel, pine will do well enough; but if ornament be the primary consideration, some choicer material may as well be used. Even painted pine, however, is not to be despised. Whatever the wood, three pieces, each 6 ft. long by 2 in. wide, of 1 in. stuff, will be required. From one piece cut a length of about 1 ft. This short piece will form the centre-piece near the top, and to it is hinged the leg which extends backwards. The two other pieces, of course, form the front legs, against which the canvas rests. Now, to provide for the backward slope of the centre leg—which, it will be observed, is hinged in front—due allowance must be made by cutting the contiguous ends of the centre portion on the bevel, as shown in section, Fig. 2. Naturally, the wider the bevel, the more

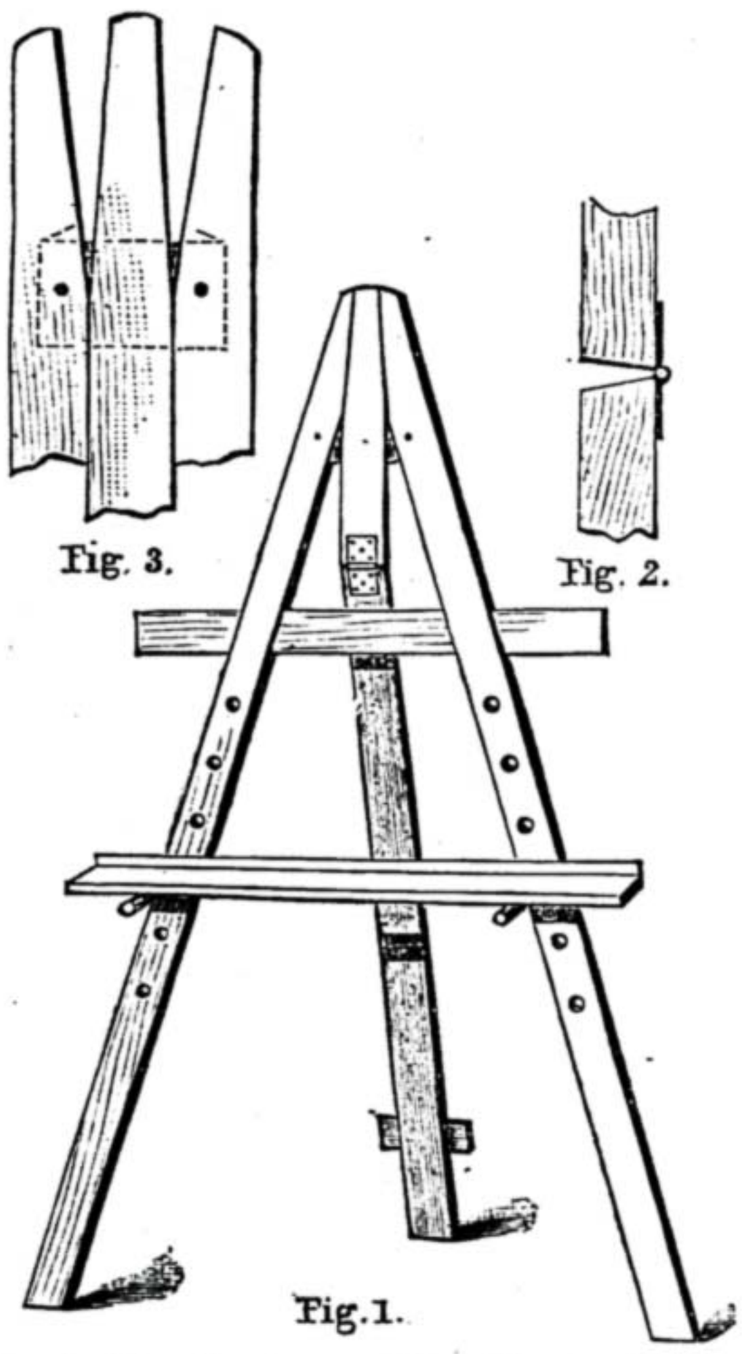

Fig. 1.—The Easel complete. Fig. 2.—Joint of Centre Leg. Fig. 3.—Hinged Attachment of Top.

the centre leg can be thrown backwards, and the consequent slope of the easel in front be increased. It is, however, unnecessary to have the bevel too great, and the proportion shown in the diagram (Fig. 2) will do very well.

The outward slope of the front legs from top to bottom must also be arranged for by tapering off the short centre-piece on both edges, and one edge of each of the outer pieces, for a corresponding length of, say, 7 in. The exact amount of taper is not important, but if it is arranged so that the extreme measurement across from leg to leg when they are splayed is about 2 ft. 6 in., every purpose will be served. The degree of taper can easily be got by actual trial when making the easel, or from either a full-sized drawing, or from one to scale.

Presuming this to have been satisfactorily done, the foot-long centre-piece must be hinged to the outer pieces; and to explain this, the diagram (Fig. 3) must be referred to. The dotted lines represent a thin ($\frac{1}{4}$ in.) piece of wood which passes through the centre-piece, in which a mortise is cut for the purpose. It projects about $1\frac{1}{2}$ in. on each side, and for the reception of these projections, corresponding mortises are cut in the outer, or front, legs. These mortises, it will be noted, must be cut wider (as indicated by the thick dotted lines) than the tenons or projections which fit into them, otherwise it would be impossible to fold the easel.

If now a wire pin be run through at the points shown, it will be found that a very convenient hinge for a folding easel has been formed. To attach the centre leg to the top part, a plain "back flap" hinge is all that is needed.

To give rigidity to the easel when opened out, a hook and eye should be fastened at the back near the top. The hook, of course, is screwed to one of the outer portions, and the eye to the other, so that the easel cannot collapse sideways. Some attention should be paid to getting the hook and eye fixed at exactly the right distance apart, which, it seems almost unnecessary to say, is just as much as will allow them to be used when the easel is unfolded.

The principal part of the easel is now made, but the arrangement for supporting the picture—or, rather, the canvas—has still to be considered. It is, however, so simple that directions may almost be regarded as superfluous, for it is only necessary to bore half-inch holes through the front legs and fit a couple of pegs to them. The holes may conveniently be 4 in. apart, and the pegs about the same length.

It will occasionally be found convenient to use a small tray or ledge on these pegs, and the easel can hardly be considered complete without one. Any piece of $\frac{3}{4}$ in. stuff of suitable length and width—say, 2 ft. by 3 in.—will do to form this of, and if provided with a low guard or rim, bradded on, it will be all the better.

A thin piece of wood will also be noticed running through both outer pieces and projecting beyond them. It is merely a piece of $\frac{1}{4}$ in. stuff about $1\frac{1}{2}$ in. wide, and is useful as a rest for the mahl stick, as well as serving other obvious purposes.

So far the easel is complete when opened; but to keep the three legs together when closed, the short tenon seen near the bottom is useful. It is very similar to the hinge-piece at the top; the principal difference being that it need not be so large, and that it fits tightly into the mortises in the sides.

Our easel may now be regarded as complete, and ready for either indoor or out-of-door purposes. When not in use, it can be folded up and put away in a corner, while its size (6 ft. by 6 in. by 1 in.) renders it sufficiently portable when sketching from nature. As the loose pieces may be considered inconvenient when carrying the easel, it may be suggested that a hole—or, rather, a couple of holes—through them, corresponding with others in the easel, will enable, by means of the pegs, the whole to be formed into one package.

Now a hint to those who are beginners in out-of-door work how to steady the easel on a windy day. Just tie one end of a piece of string anywhere near the top of the easel—say, by the hinge in the middle piece—and to the other end, hanging down to near the ground, fasten a weight. A good-sized stone will do as well as anything. Then, "when the stormy winds do blow," the artist may sit at work, if not as comfortably, at least as secure from upset as in his studio—provided always that his canvas has been properly secured, and that it is not too large for the weight.

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OUR GUIDE TO GOOD THINGS.

*** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of any one who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

70.—Slatter and Watkins' Improved Inlet Double Check Gas Regulators.

Any machine or appliance that can exercise a complete, and therefore, from the consumer's point of view, wholesome control over the consumption of gas is a thing that ought to be welcomed and adopted in every dwelling-house

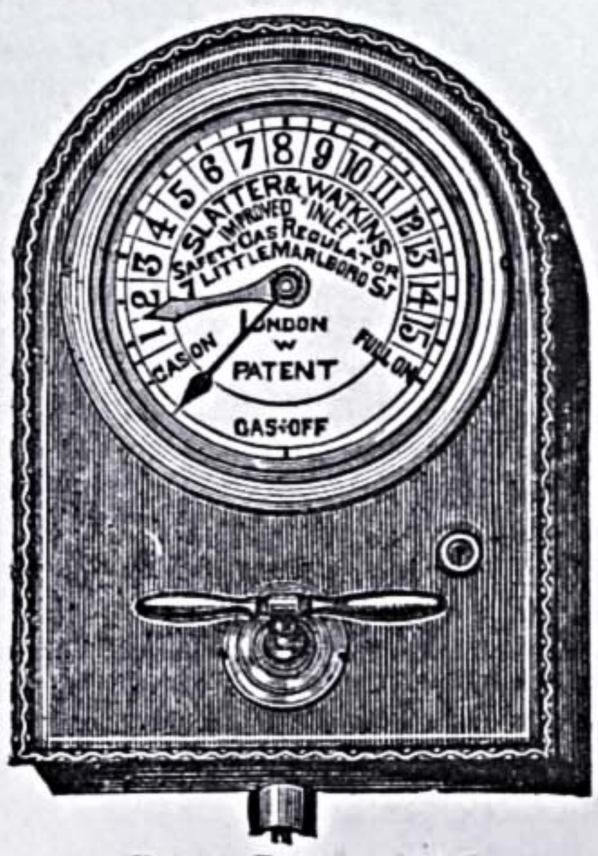

Fig. 1.—Front: closed.

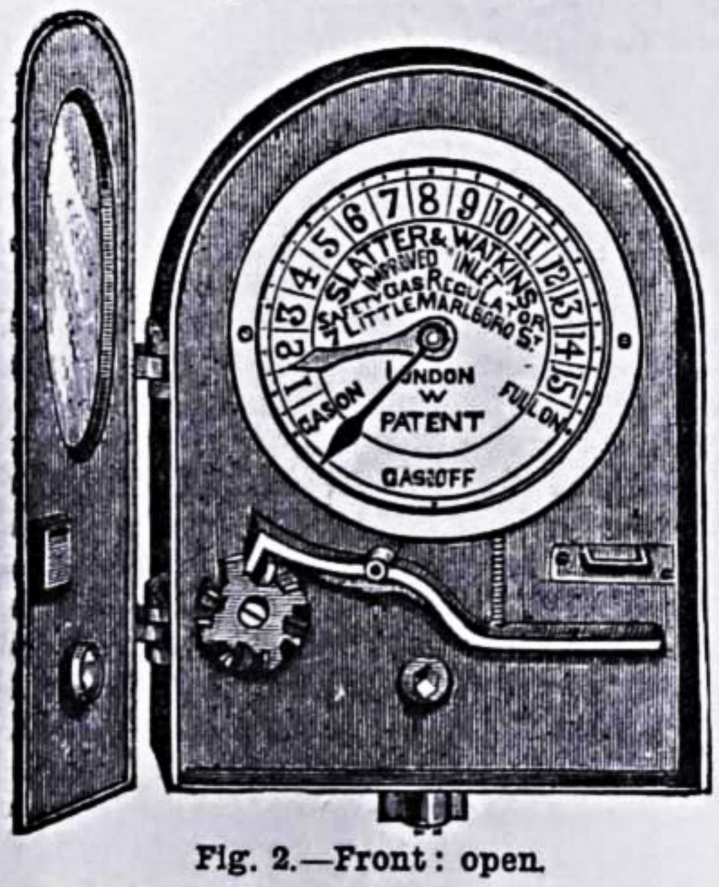

Fig. 2.—Front: open.

Inlet Safety Double Check Gas Regulator.

or establishment where gas is burnt, whether on a small scale or on a large. My unhappy experience of lighting by gas has been that the consumption is always on the *crescendo* scale, and that do what I will to be careful, the returns and charges for gas burnt in any particular year indicate a progressive increase on those for the year before. I always preserve the cards on which the examiners of the particular Gas Light Company from which I draw my supply enter the results of their inquisition, and note with anything but pleasure the manner in which leeway seems to be made up whenever any apparently generous concession has been made to the consumers in the form of a reduction in the price per 1,000 cubic feet of gas. Indeed, if gas companies give with one hand, they certainly take with the other, and the taking bears such preponderance over the giving as to quench entirely any feeling of gratitude for the gift on the part of its recipients. How it is all managed I do not know, and I will forbear from offering any theory of my own in explanation. I am glad to learn from Messrs. Slatter & Watkins, gas engineers, 7, Little Marlborough Street, Regent Street, London, that they have invented and patented, and manufacture and supply, a means of controlling the supply of gas in their "Improved Inlet Double Check Gas Regulators," which are sold in five sizes suitable for various sizes of mains, from £3 10s. to £6 10s. The object in view in the adoption and use of this invention is to enable consumers to have full control of the supply *before* the gas enters the meter, and thus to check the pressure and admit only such quantity of gas as may be at the time required. In the accompanying illustrations, Fig. 1 shows the regulator with the front closed, and Fig. 2 with the front open. In Figs. 1 and 2 the dial above shows the means of regulating the supply, and in Fig. 2, in which the front is unlocked and open, a stop action, consisting of a lever acting on a notched wheel, is shown below the dial, and by this the owner of the house and, presumably, the man who pays for the gas is enabled to prevent *employés* turning on more gas than is required either by means of the key

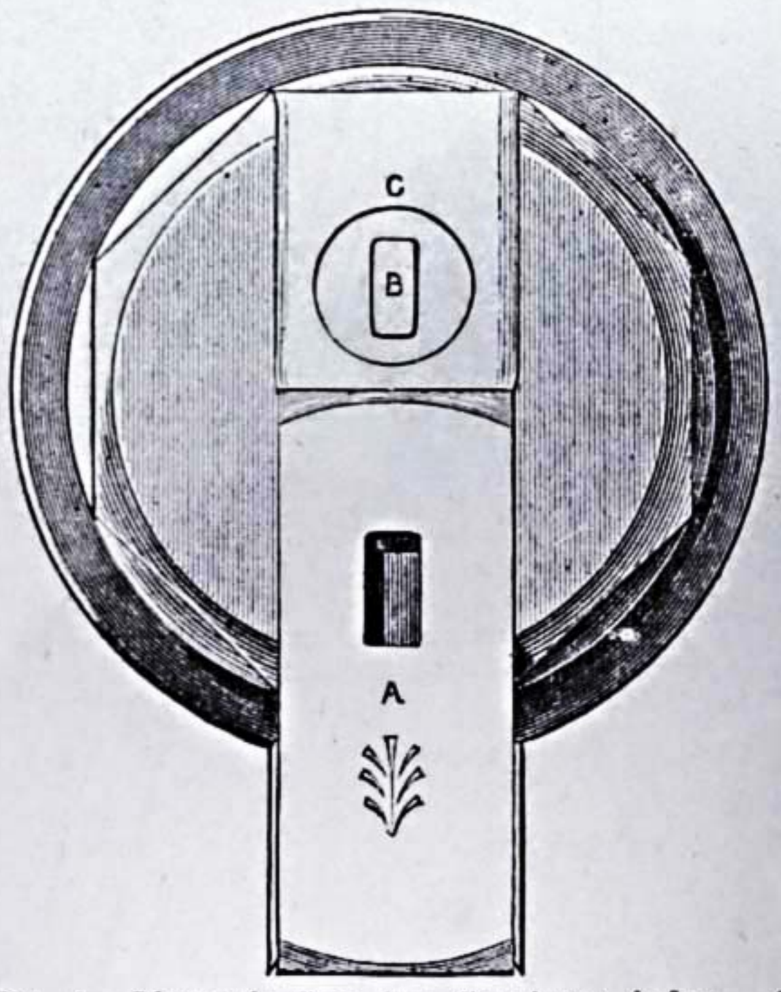

Fig. 3.—Linney's Cap for Carriage Axles—A, Sliding Plate; B, Stud on Spring; C, Plug containing Stud and Spring.

or by tampering at the meter. It will be noticed that the portion of the circle on the dial between the points "Gas on" and "Full on" is divided into sixteen parts, showing a wide range for regulation. The broad shaded hand shows to what extent the entrance of gas into the meter is regulated by the lever and notched wheel below the dial shown in Fig. 2, and the black hand, whether the gas is on or off, and this hand is actuated by the key shown *in situ* in Fig. 1. The stop hand, it will be noticed, is set in the engravings on the line midway between 1 and 2, or, in other words, to 1½ divisions, and the stop hand being thus fixed, it is impossible to move the black hand beyond it and thus obtain a greater pressure of gas. In this, then, lies the check on the consumption, and the "double check" consists in the fact than when the householder has regulated the stop action, he has only to lock the door and put the key in his pocket, and so prevent any alteration of the stop hand until he is pleased to alter it himself. As the apparatus can be placed in any part of the premises, the owner has full control over the supply from the room where the regulator is fixed, no matter where the gas meter may be situated.

71.—Linney's Cap for Carriage Axles.

Mr. Alfred M. Linney, Bedworth, Nuneaton, sends a model of an Improved Box or Cap for Carriage Axles that he has recently invented and made, and provisionally protected. Some idea of the cap and its utility may be gathered from the accompanying illustration of it in plan, given in Fig. 3. I will take it for granted that the reader is acquainted with the ordinary cap or box that covers and hides from view each end of the axle on which the wheels turn, Collinge's Patent being the form most used for carriages. This is screwed into a tube or collar, and when it is necessary to oil the axle the cap is removed and screwed up again by means of a wrench. A broad, dovetail groove about ⅛ inch deep is cut in the top of the cap, and in this groove a sliding plate A moves, which is stopped from moving beyond a certain length, and therefore from being taken off and lost, by a pin that moves in a groove cut in the direction of its length in the under side. A slot is cut in this plate, and when in its proper position the spring B rises from the plug C and enters the slot, rising a little above it. When the plate A is withdrawn as shown in Fig. 3, the plug C can be removed and oil poured in through the hole occupied by the plug for the purpose of oiling the axle. Thus oiling is at all times easily effected without unscrewing the whole box with the wrench. Mr. Linney urges that the use of his cap causes "a great saving of labour, time, and expense as regards oil, which often runs half away before the cap is screwed on, besides the trouble which is avoided of often having to hunt for a lost spanner." Further he says: "It would be an especial boon to large cab proprietors, 'bus companies, bread companies,

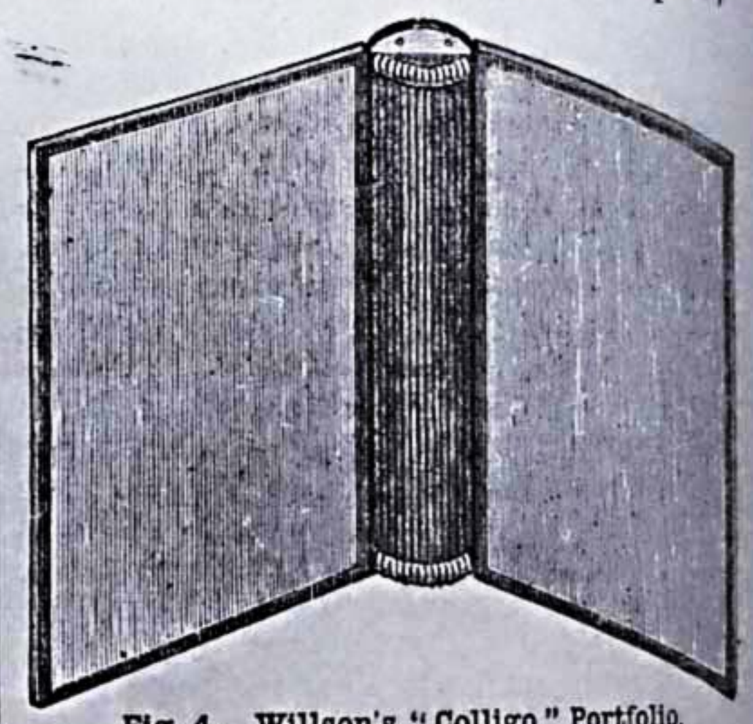

Fig. 4.—Willson's "Colligo" Portfolio.

etc. I have taken it to several large carriage manufacturers in Birmingham and the Midlands: they all say it is a capital thing, but they won't have anything to do with it as it would injure their business by preventing various tradesmen, merchants, and others sending their vehicles to be oiled rather than be at the trouble of doing it themselves. What it requires is for some good company to ask for them to be put on their carriages, etc.; the makers would then be compelled to make them."

72.—Two Magazine Cases.

Under this heading I must group two cases for serials, the one manufactured and sold by Messrs. Walter Brampton & Co., 24, Masshouse Lane, Birmingham, known as "The Automatic Spring Letter Case," and the other, the "Colligo" Portfolio, made by Messrs. E. J. Willson and Son, 21, St. Bride St., Ludgate Circus, London, E.C. In the former the numbers of a publication are held by a strong spring which forms the back, and which acts as a clip along the back edge of the magazines, holding them firmly in place by a strong pressure. The numbers are released by pressing on the front edge of the upper board of the case. The "Colligo" Portfolio shown in Fig. 4 has a curved back made of wood with brass clamps at each end, in which fifty-two elastics or strings are firmly fastened. The advantages possessed by this portfolio are that it opens flatter than a bound book; that there is no piercing or mutilation of serials; no margin taken up in filing, and the contents of each page can be read to the very edge. Any paper can be removed without interfering with the others. A case for WORK costs 2s. 4d., or with gold-lettered title, 2s. 10d.

THE EDITOR.

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SHOP:

A Corner for Those who Want to Talk It.

NOTICE TO CORRESPONDENTS.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

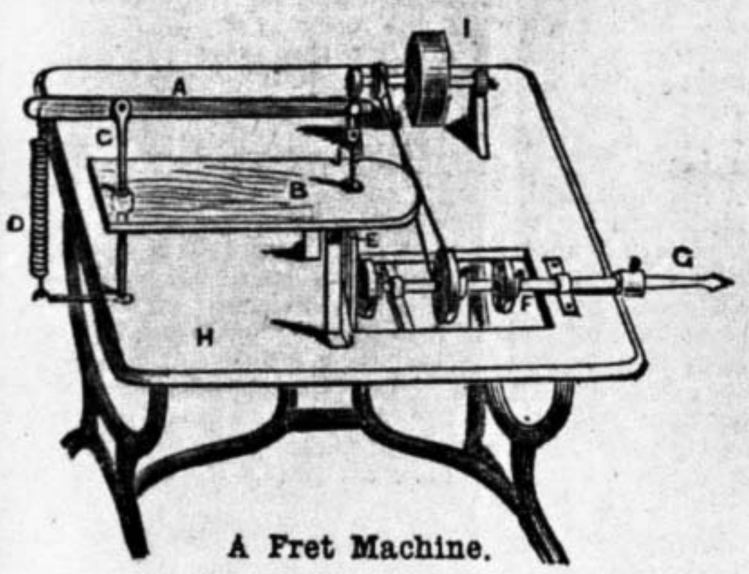
In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Macpherson's Foochow Enamel. — MESSRS. DONALD MACPHERSON & Co. (*Knott Mill, Manchester*), referring to my notice of their excellent enamel paints in page 370, write:—"We must ask you to correct the statement that we are more or less successful imitators of Mr. Aspinall. We do not wish to say anything about imitation, except that as 'Foochow Enamel' was before the public at least two years previous to Mr. Aspinall's manufacture, *we*, at least, are not imitators."—I stand corrected, and correct with pleasure, the mistake of attributing priority of existence to the younger—brother, may I say? being due to the fact that I became acquainted with the junior enamel first, and thus arrived, perhaps too hastily, at the conclusion that it was the senior. Both are good—so good that I may re-echo Captain Macheath, and say, "How happy could I be with either, were t'other dear charmer away;" and hope I may never be in the position of the ass of the mediæval schoolmen, who took pleasure in supposing that if the said animal were placed exactly midway between two bundles of hay of precisely the same weight and excellence of aroma and flavour, he or she, whether Jack or Jenny, as the case might be, would never be able to determine which to attack first, and so would perish of hunger in the midst of plenty. I am afraid the schoolmen had the best claim to the name by which *Equus asinus* is known in the vulgar tongue.—ED.

Freezing Liquids (Correction). — F. B. C. writes:—"In my reply to INQUIRER (*Yeovil*), the 'minus' sign should have been printed before each temperature given, as -7°, -10°, etc."

A Fret Machine.—G. C. (*Huddersfield*) writes:—"I send you a rough sketch of a fret machine which I consider a good one. First, I got an old sewing machine top with treadle wheel, etc. Now I will describe the parts I put to it of my own make as well as I can. A is a piece of hard wood 20 in. long—a lever I call it; B is a piece of oak board for the fret table independent of the machine top; C is a piece of ½ round iron screwed at one end as far as 8½ in., so that it will hold to both tables; the other end is a joint with a hole through for A to work in; D is a spring fixed to A and machine top; E is a wood slide cut like a carriage slide on a lathe; F is a steel shaft with three wheels, two for bands to run in, and the other is like a face plate with stud in to work in iron slide fast to E wood slide, which is fastened to sewing machine top; the other



A Fret Machine.

end of shaft F is a hole for a number of drills, which can be taken out at will; G is for drills; H is sewing machine stand; I is a shaft running into two pivot screws with collar and nut to screw off glazier, or small grindstone, or a small circular saw at will; J is the saw which passes through B table. I have seen all your various machines in your valuable paper, and none of them are bad ones, but some are better than others; mine does not make any more noise than a sewing machine, and it runs very quickly with having a small pulley on shaft; when not using the saw you loose the screw in the face plate; with stud in you get all the power for drill or grindstone, which you like. It does its work up to the mark. It works perfectly upright stroke with saw. I saw wood with it an inch in thickness. I hope you will put it in your paper for the benefit of your readers. You can sketch it off better than I have drawn it here, but I think any one will understand it. It cost me 18s. altogether: machine with treadle 5s.; the other parts various prices, amounting to the above sum."

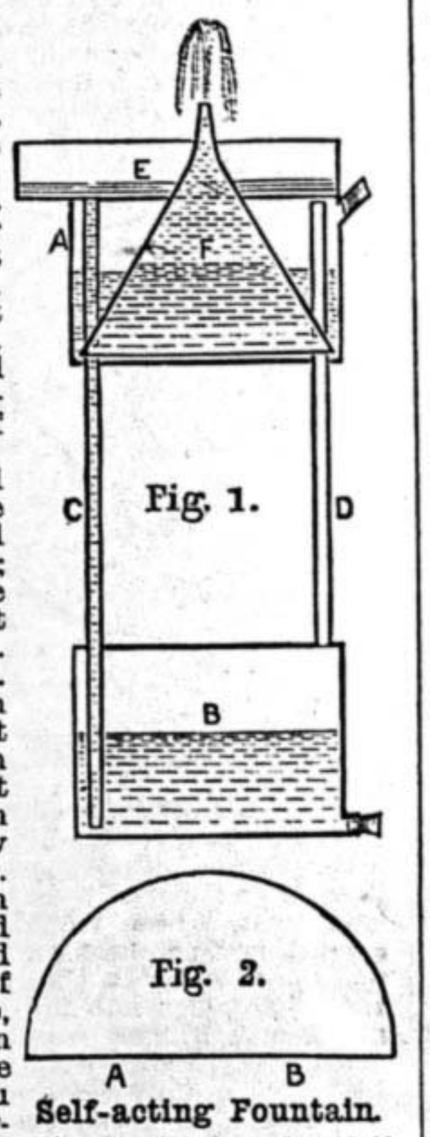
Folding Chair.—W. C. W. (*Chiswick*) writes:—"In G. LE B.'s drawing of folding chair, No. 58, Vol. II., 'Shop,' is there not a mistake? or how is the chair held together? The arm is shown as in Fig. 1; should it not be as in Fig. 2?

Fig. 1.—Arm as shown.

Fig. 2.—Arm as it should be.

and then I should not trust it much unless strengthened with a metal plate. If any reader should require it, I shall be happy to give sketch and dimensions of chair to fold flat and avoid the curved arms cut across the grain. I take in WORK regularly and read it eagerly, as there is much information in it valuable to amateurs."

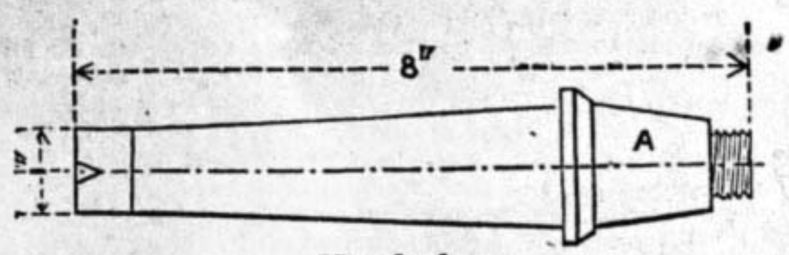
Self-acting Fountain. — F. H. (*Streatham, S.W.*) writes:—"The fountain described in No. 69 of WORK, page 265, is very well to look at, but constructed as Mr. G. Maynard Walker has drawn it in Figs. 1 and 3 it would, in my opinion, be a failure. A fountain can be made on Hero's plan, and I myself have made several; but I have found from experience, to make them work with certainty, the part marked F, in Figs. 2 and 3, on page 265, should be made the shape of a funnel. I need not give here full instructions for making a similar fountain, for Mr. G. Maynard Walker has given very plain instructions on page 266, so I will proceed with describing how to make the part marked F in the drawing below. With a pair of compasses, the diameter of A as radius, describe the half of a circle on a sheet of tin or zinc; cut it out and bend it round until A and B, Fig. 2, meet; then bend it till it slips easily into A, Fig. 1. The bottom of the funnel should be ¼ less in diameter than the bottom of A. Solder the joint A B, place it again into A, and mark from the bottom the place for the tubes C and D; solder C and D into F; pass C and D through the bottom of A, and adjust it so that F is about $\frac{1}{16}$ in. above the bottom of A. The tops of C and D can now be filed their right height: C going through the bottom of E, D about $\frac{1}{16}$ away from the bottom of E. A pin hole can now be made in the top of F. If F is not long enough to reach the desired height, file the top off and solder a small piece of bent brass on the top, making a small hole in the top. I hope I have made all clear, and you will find with this arrangement the fountain will work well. To start it working, A should be filled with water, the plug fixed, and a little water poured into E; the fountain will start working at once."



Self-acting Fountain.

Fig. 1.—Section of a Self-acting Fountain.
Fig. 2.—Shape of F in Fig. 1 before it is bent and soldered.

Cost of Mandrel.—J. T. (*Walworth*) writes, in reference to a previous communication on this subject (page 159):—"The subjoined is a drawing of the



Mandrel.

mandrel which the Britannia Company wanted 30s. to make. The part A was to be case-hardened, that was all. I may be wrong, but I still think the price rather tall."

Cheap Clocks (Erratum).—A. B. C. (*Parkstone*) writes:—"In WORK, Vol. II., No. 75, page 373, column 2, paragraph 3 from bottom, please put full stop after 'think.' Last line but one from bottom to read thus:—'From these you can get all you require, I should think. One is maker, the other importer.'"

Umbrella Stand.—W. C. W. (*Chiswick*) writes:—"Enclosed I send you rough sketch of umbrella stand which I have just finished, thinking it may be useful to some 'workers,' as it is easily made and effective when finished. As near as I know how, I have drawn to scale ¾ in. to a foot. The wood is pitch pine. The flooring, not shown in the drawing, is ¾ in. stuff laid on to battens screwed to the uprights, the top of it flush with the top of skirting, also ¾ in. stuff. The dotted lines show position of zinc trays made with a flange ⌐¬ and let into the flooring. The rails and skirting are stop-chamfered and fastened with round-headed brass

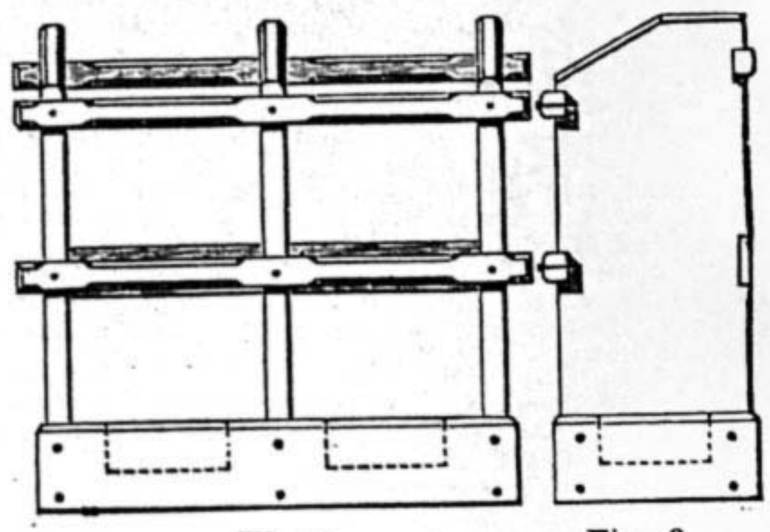


Fig. 1. Fig. 2.
Umbrella Stand.

screws. When nicely cleaned up, well papered, and with one coat of gold size, a good rub down with a bit of cloth, powdered pumice, and water; then one or two coats of good pale varnish, or carriage varnish, if procurable; no one like myself (a veritable tyro) need be ashamed of it. Of course by running up a back a convenient hat stand can be made to it."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Metal Cages, etc.—F. J. B. (*Bristol*).—For cages, wire work of every description, and materials for same, try Messrs. Cicero & Co., Clerkenwell Road, E.C. They will be able to supply you with everything you want good and cheap.—R. A.

Discoloration of Plaster Casts.—SCULPTOR.—The yellowish-green discoloration complained of, which is so apt to appear, especially on the prominent parts of casts, after drying, is doubtless owing to sulphur (plaster, be it remembered, is formed of sulphate of lime); this the moisture brings with it to the surface, and evaporating, deposits it there. The remedy is to dry the cast with its *back* to a fire. The moisture is then drawn out and the sulphur deposited where it will not be noticed.—M. M.

Cycles.—C. W. (*Kilburn*).—You will get every kind of materials and fittings for bicycles at an exceedingly cheap rate from the St. George's Cycle Company, 298, Upper Street, Islington, London. They will send catalogues, showing several patterns of safeties and tricycles, and they sell sets of stampings, tubes, and other fittings complete for any one of the patterns shown in their lists. This is about the cheapest house in the trade for reliable articles. Another good firm, but somewhat dearer in some things, is W. A. Lloyd & Co., Clyde Works, Weaman Street, Birmingham. For fittings, such as bearings and pedals, the best firm is W. Bown, 308, Summer Lane, Birmingham. His goods are not the cheapest in the market, but they are by a long way the cheapest in the end.—A. S. P.

Phonograph. — ANXIOUS PHONO.—Full directions for making the phonograph will be published as soon as space can be found, so you must try and have patience till then.—W. D.

Cold Lacquer.—G. F. (*Sheffield*).—If you want to lacquer your bedstead cold, the ordinary lacquer will not do. I should use either the silico transparent enamel, sold by the Silico Enamel Company, 97, Hampstead Road, London, N.W., or the transparent lacquer sold by Adams (late Abrahams), Photo Warehouse, Aldersgate Street, London, E.C.—R. A.

Brass Cleaning, etc.—SMADA.—I find by referring to the index of Vol. I. of WORK (which, by the way, if querists would procure and examine, they would save themselves, in many instances, much trouble and waiting) that information on brass finishing is given on pages of WORK, 366, 430, 542, 620, and on lacquering on pages 525, 572, and 779. If these do not give you all the information you require, write and specify requirements, and we will help you farther.—R. A.

Engineering Books.—A. G. (*St. Albans*).—You do not say what branch of the trade you require information on. At haphazard I therefore mention the following:—"The Complete Practical Machinist," by Joshua Rose, 12s. 6d.: Spon. "The Work Manager's Handbook," Hutton, 15s.: Lockwood. "A Text Book on Steam and Steam Engines," Jamieson, 7s. 6d.: Griffin. "The Mechanics of Machinery," Kennedy, 10s. 6d.: Macmillan.—J.

Cycle Cement.—The address you ask for is Brown Brothers (late Snell & Brown), The Cycleries, 7, Great Eastern Street, London, E.C.—A. S. P.

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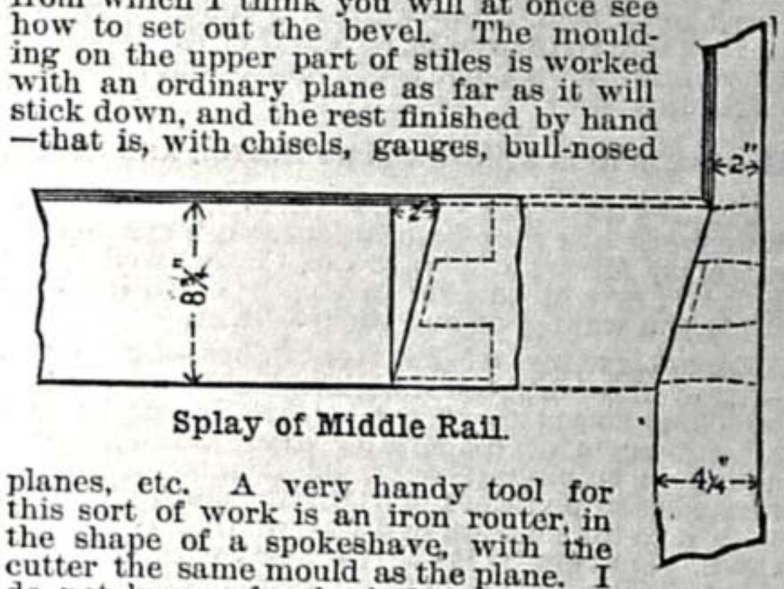
Fountain.—CHOPSTICK.—The simplest way out of your difficulty of getting six gallons of water back to the top of garden wall from whence it had supplied a fountain. would be to let the waste run into a portable cistern holding rather more than the other—which would be out of the way at the foot of the dwarf wall, as per your sketch; you will then require to rig up a framework over your wall cistern to attach a pulley wheel thereto capable of bearing a weight of about 60 lbs.; now, by attaching a strong line to your waste tank and hauling thereon, it is easily lifted to the required height; you could also readily attach some projection to the moving tank that would cause it to tip up at the required height and empty into the supply tank. If the job is in an exposed situation you might probably use a small windmill and pump. Another feasible plan would be to let the waste water run into a strong tank connected by a pipe from nearly the bottom to the top of supply tank, and connected by a flexible pipe to a strong pair of bellows; by turning off the inlet of waste and using the bellows (with clack valve) the water would be forced up in a few minutes. In any case it means some kind of energy exerted equal at least to the force expended by the fall of water from the wall to the fountain. You see it is the old story of Humpty, Dumpty, sat on a wall, etc., and nothing will set him up again but work.—C. M. W.

Sash Door.—J. A. N. (*Portsmouth*).—In making a sash door, or any kind of diminished stile framing, the bevel is generally roughly cut first, and after the stile is mortised the exact bevel is marked with a scribing knife, and the superfluous wood carefully taken off with a sharp paring chisel, and, if necessary, finished with a bull-nosed plane. Some men who make these doors by piece-work cut the bevel at once with a fine panel saw, and I have seen very nice jobs turned out this way. But, of course, you cannot do this, although it is advisable, even in your case, to cut as near as you dare the first time. I have given a little sketch from which I think you will at once see how to set out the bevel. The moulding on the upper part of stiles is worked with an ordinary plane as far as it will stick down, and the rest finished by hand—that is, with chisels, gauges, bull-nosed



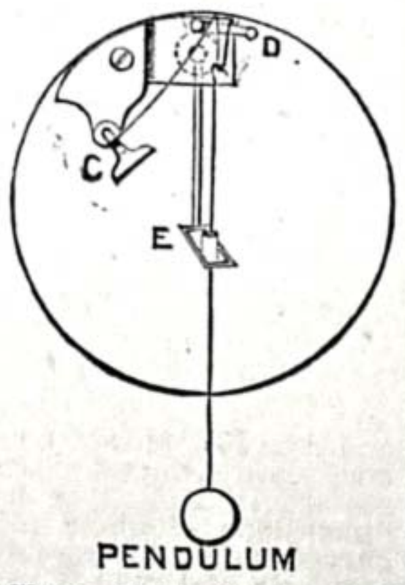
Splay of Middle Rail.

planes, etc. A very handy tool for this sort of work is an iron router, in the shape of a spokeshave, with the cutter the same mould as the plane. I do not know of a book devoted entirely to sash making, but any standard work on joinery treats more or less of this subject. If at any time any difficulty occurs to you, I shall be only too pleased through the medium of WORK to put it right; always bearing in mind that the more explicit your questions are the more definite your answers will be.—E. D.

Band Saw Brazing.—G. W. (*Snodland*).—I would advise you to get No. 36, Vol. I. of WORK, if you have not got it, and see remarks on band saw brazing on page 571, which I think are very simple and clear. G. W. should first file the ends of saw the length of two or two and a half teeth, so that when they lap over each other they may be about the thickness or a very little thicker than the other part of saw. Now place the saw in position for brazing, then damp the ends with water, or even your own spittle will do; then take some borax, and beat it into a powder with a hammer; with the borax mix a little coarse brass spelter; put a small quantity between the ends of saw, or where they lap; close a pair of bright hot tongs on it until you see the spelter run; remove the tongs, and close tightly a pair of black hot tongs for a minute or so; remove it, and lightly file the joint to the thickness of saw. If you wish to improve the look of the braze, rub it a little with emery cloth. As G. W. has had nothing to do with band saws, I would call his attention to remarks on "Band Saw Machines and Band Saws" (No. 35, page 556, Vol. I. of WORK); also to my reply in No. 39, page 622, to which the signature F. C. (*Leytonstone*) is attached.—A. R.

Black Stone.—BLACK STONE.—I am sorry to be unable to give any satisfactory information regarding the black stone of the engine turner, engraver, and diamond setter. I am, however, informed by a practical man from Clerkenwell, that the black stone is identical with the touchstone of the gold jewellery assayer. If such is the case, which may or may not be, I have no means of substantiating. "Touchstone was originally brought from Lydia, in Asia Minor, and consists of a coarse-grained quartz saturated with bituminous matter." "Touchstone, a hard black stone, occasionally used in assaying, of a peculiar bituminous quality, obtained from Lydia, in Asia Minor." The above paragraphs are extracts from an old encyclopædia, and if the two stones can be identified I think that will settle the question. Perhaps some other correspondent will favour us with his views of the subject, making his communication as brief as possible, as there is enormous pressure on the space devoted to "Shop."—N. M.

Clock Repairs.—P. W. (*Ashton-under-Lyne*).—From your query and sketch, the clock is a French one with silk suspension, which is broken. Take a silk thread, tie a knot in one end, pass it through the hole in the stud D, nearest the plate, passing it *down* from above; then thread it *up* through the hole nearest end of stud; now pass it through the hole in the stud C, and tie a knot, leaving about half an inch free; now draw the loop down that is formed by passing the thread through the two holes in the stud D, and hang your pendulum on it. To regulate, turn the milled-headed stud to the right, screwing the pendulum up; to make it go slower, let the pendulum down. I usually put the silk long enough to let the top of the piece of brass on the pendulum that fits in the crutch E be even with the crutch. Then regulate by driving it up by turning the milled stud.—A. B. C.



Clock Back Plate and Parts.

Watch Repairs.—R. M. (*London, S.W.*).—The watch chain may be repaired if not broken in too many pieces, or any of them gone; if so, it will be better and cheaper to get a new one, which may be had from the tool shops for about 2s. The pin in the lever—if it is the lever—is simply a brass one, which you can easily replace by filing up a piece of brass wire and nicely burnishing it to make it smooth and hard; push out the old piece by the point of a needle from above, and put in new one from below, or where the pallets are; give it a tap with a small hammer, and cut off the top to about the thickness of the lever, and smooth off nicely so that there shall be no burr left on. If it is the pin (ruby pin) in the roller, take it off (the roller), put it on the point of a needle, and make slightly warm; then push out the stump with a needle point. If you have no ruby pins by you, a very good substitute may be made from a bit of gold or even brass wire, filed up nice and round and true, and burnished hard and smooth. Push it in from the back part; cut it off long enough to come down through the lever, and round off the end. *Cases.*—Unless the lever movement is a thorough good one, I don't think it would be worth the expense of fitting a face and case to it, which would probably cost 25s. to 30s., according to weight and style. *Verge Case.*—I do not know where a common case could be got for the above, or what the cost would be; if it were mine, and it was worth anything at all, or had any history, I should make a small imitation grandfather case, or something of that style, and make a mantelshelf timepiece of it. From your sketch I should say it was a stop arrangement. A long pin goes through the plate at A, and when the lever is moved it catches in the fourth wheel and stops the train till thrown out by pressing back the lever.—A. B. C.

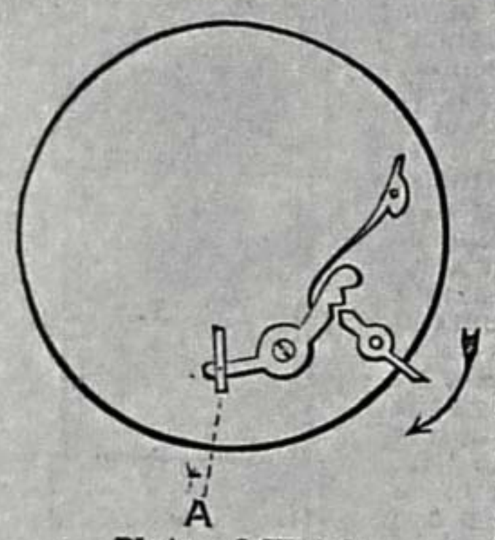


Plate of Watch.

How to Pivot a Watch.—O. L. (*Bristol*).—A very simple question it may seem, but not easy to answer: how to pivot a watch and a list of all the tools required and their cost. Well, to begin, there are the turns, 8s. or 10s., or a lathe, £5 or £6—one or other you must have. Next come screw ferrules, wax ferrules, and spring ferrules, prices from 6d. to 1s. 6d.; gut and hair bows, 6d. or so; arbors, 3s. to 6s. per set; gravers, about 4d. each; oblong, square, and oval polishers, files and burnishers, price from a few pence to 1s. or 1s. 6d.; callipers, gauges, and height tools, and, in fact, so many others of one sort and another, that if you mean to finish a watch you would require a regular kit, but your question is so indefinite that I cannot advise you further than above without knowing what more you intend doing; if you mean simply to put in a pinion, then a pair of turns, a bow, a screw ferrule, and a graver, with a pinion gauge to measure the size, length, etc., you would find sufficient. If this is not what you require, write again, and give more particulars.—A. B. C.

Wet Walls.—GATESHEAD.—If the dampness appears first near the floor, and rises upwards, it is no doubt caused by the absence of a damp-resisting course. If the dampness is on the inner or partition walls as well as the outside walls, the only remedy will be the insertion of a damp course; but if on the outer walls only, it may be caused by the earth outside being above the level of the floor, in which case the earth should be lowered six inches below the floor, and the wall thus uncovered should be plastered with Portland cement. If the tops of the walls are damp, it may be from the roof or spouts and down-pipes leaking; these should be examined and put right. Or the walls may be built of porous stone, which allows wet to penetrate. In this case it should be plastered with cement outside, and when dry painted, or the joints in the wall might be pointed with cement, and the wall painted over with Morse's colourless solution for damp walls. If sea sand has been used it would account for the dampness, and the effects of this are said to be incurable; but you might give it a coat or two of the above-named solution, which is highly recommended. Another method which is sometimes adopted is to fix battens about 1 in. thick and 16 in. apart against the interior of the walls, and lath and plaster upon them, leaving a cavity between the lathing and the outer walls. When done in this manner, a small hole should be left at the top and bottom of each space, between the battens, to allow the air to circulate through them. It might save expense if you used Willesden waterproof paper, nailed on the battens, instead of lath and plaster. It is most probable that the dampness is caused by one or more of the above causes, and the most effectual remedy will be at the outside of the walls rather than the inside.—M.

Top-jointing Tool.—NO NAME.—The first essential, in order to have a saw in perfect working trim, is that the teeth may be uniform in length. Making them so is, in my country, called "ranging," but I believe "top-jointing" is the proper term. The tool of which I give a sketch differs, I think, from

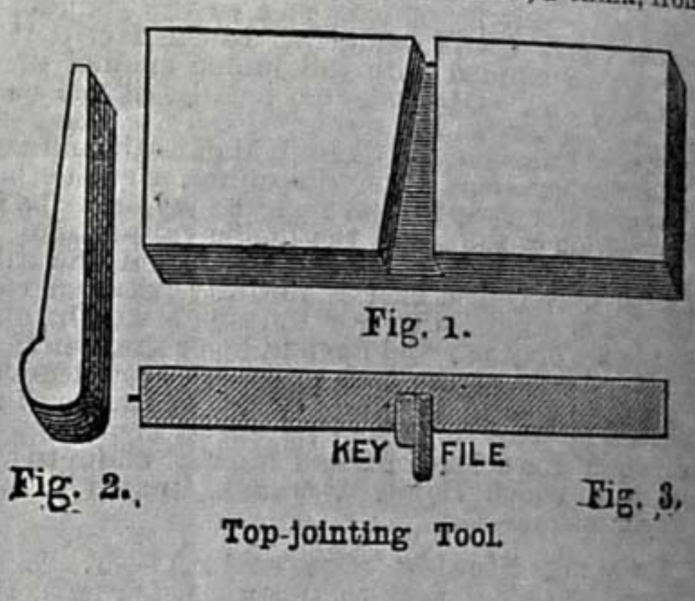


Fig. 1. Fig. 2. Fig. 3.

Top-jointing Tool.

those usually recommended, and for the benefit of amateur readers—professionals, of course, know of it already—I give a short description. Procure a small block of beech, say 7 in. by 4 in. by 1 in.; cut out the tapered groove, as shown in Fig. 1. to the depth of about ½ in.; one side of this groove must be at right angles to the sides of the block. Make the key (Fig. 2), which is to secure a flat "mill" file in position, as represented at Fig. 3. and you have the handiest contrivance for the purpose in view.—OPIFEX.

Copying Processes.—J. C. M. (*Bristol*).—I have a receipt which, although I have not tried it myself, is given me as very good for making a "graph," or surface capable of taking a printable original for circulars, etc. Gelatine, 10 oz.; indiarubber, 1 oz.; oxalic acid, 1 oz.; glycerine, ½ pint; water, ½ pint. I am told that the difficulty is to dissolve the indiarubber, but think that if the gelatine, glycerine, and oxalic acid are heated together, and the indiarubber be cut very small and gradually stirred in before adding the water, they should blend well together. The best apparatus, and, I should say, a far cheaper one to buy than to make, is Fordham & Smith's litho copying apparatus (Wormwood Street, London, E.C.), which gives splendid results in any colour of ink; each plate can be washed out, and gives six originals; plates only cost 1s. each (*i.e.*, about 2d. per circular), and will give off 100 to 150 copies, or 750 copies of six different (or even the same original) writings. No pressure is required—merely rubbing the hand over the back of the paper being quite sufficient to print a full, clear, bright impression in black or coloured, permanent or copyable printing ink as the case may be. If J. C. M. writes to the above address, he will receive all particulars per return.—J. W. H.

Life-saving Apparatus.—C. B. (*Sheffield*).—Nothing I can suggest is better than the life-buoy, as supplied to ships for the purpose you mention. Your idea of a bag of indiarubber in a loose net would not answer, as it would be very cumbersome, and if not inflated beforehand would be useless, as there would not then be time to do so. Its weight, if made sufficiently strong to resist the force of the waves, would be very considerable, and therefore the expense would also be great, and if made light and portable it would be sure to burst.—J. W. H.

Photographic Developer.—CONSTANT READER.—You cannot do better than carefully study some elementary work on photography, many such are published. To be a good photographer a considerable amount of knowledge and practice is required.

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It is not done by hop, skip, and jump, as CONSTANT READER seems to imagine. As a preliminary to attaining that desirable end, it is necessary to know the names and qualities of the apparatus and chemicals used. To reply to the questions asked about solutions and crystals is impossible with any amount of accuracy; appearance and colour are very indefinite guides by themselves—in fact, none at all. The assumption is that they consist of the usual chemicals photographers use; but the only thing that CONSTANT READER can do is, in the first place, to learn something about the art, either from books or by being taught by some one already skilled in the matter.—D.

Glass Calculator.—G. M. (*Clapham*).—I have seen a glass calculator upon cardboard to hang upon the wall about the size you name, and which, I think, is what you inquire about, but, like the one you saw, it is very old; however, I will give you the address which is on the card, and hope you may succeed in getting one; but whether the firm is still at that address I cannot say: The Lic. Vit. and Hotel Keepers' Glass and Supply Company, Limited, 25, Great Queen Street, Lincoln's Inn Fields; or at 112, Southampton Row, Russell Square. I hope you may succeed.—W. E. D., JR.

Stationery Holder. — J. M. (*Dundalk*). — Curiously enough I have had two letters handed to me (yours and one from E. M., *Peterhead*) at the same time, both requesting the same particulars, viz., whether I would supply full-size designs of the stationery holder I gave in the supplement to No. 66, Vol. II., page 228, my price for such, and what wood is most suitable to make it with. To the first question I must say I am always willing to supply full-size working drawings of any of my articles, stationery holder included, should any difficulty arise in reproducing the miniature sketches given. Concerning the second query, I cannot quote any of my prices here, as that action would amount to a free advertisement; and it is my earnest desire not to be found contriving to gain such an end. I have taken advantage of the envelope you have enclosed to write to you personally. It is unusual for us to reply by post, but in your case, by doing so, I am not withholding any particular information of service to other readers.—J. S.

Waterproofing.—S. T. (*Rupert Street*).—We do not know how you can avoid the smell you complain of; evidently the substitution of the material proposed for the beeswax used will not do it. We think we shall be able to show you that before long the difficulties you complain of will be found to have vanished, and that a useful, valuable, and convenient means of overcoming the present difficulties will be readily obtainable. We do not know the materials used or the mode of manufacture, it being a secret. The subject has occupied the inventor for many years.—C. E.

Designing an Aquarium.—Q. B. (*Wheatley*).—If I were about to design an aquarium and aviary combined I should leave out entirely the "four turned mahogany pillars" you speak of, as the use of wood in connection with water necessitates a somewhat heavy and clumsy kind of fitting in order to secure sufficient strength to resist the pressure. If you must use up these pillars I would use only two of them to make up a neat and substantial aquarium of small dimensions at first, say, 24 in. long, 12 in. wide, and 14 in. deep, thus using four lengths of pillar 14 in. each; these will require to be rebated to receive the glass sides; this is best done at a saw mill, with a circular saw, cut in a full ½ in. You will get the maximum strength of frame with the lightest material by making the top and bottom frame in the form of Oxford frames (without rebates); these being fitted to the pillars upon the lines of the rebates of the pillars, will allow the glass sides to be fitted so that no water will touch the woodwork when the glass is cemented in and well set. A self-fitting bottom is easily made by pouring in a batter of Roman cement, to about ¼ in. above the bottom frame—having previously fastened, say, three cross ties underneath the frame flush with the bottom. When the cement is set hard and thoroughly dry, the interior joints must be varnished with copal varnish; four turned knobs for the top corners would give a neat finish. If you require more write again.—C. M. W.

Heat from Stove Pipe.—W. P. (*Southport*).—There is a kind of hair felt used for covering boilers, cisterns, and hot-water pipes, to prevent loss of heat by radiation, but I think the great heat from a stove pipe would char this and cause an unpleasant smell. The only other article that I know of is Bell's asbestos non-conducting composition; it is stated to be free from any substance that will injure metal, and to be of such a nature as to adhere without bands for years; it is sold in sacks, 15s. and 25s. per cwt., and is mixed and applied like plaster. But could you not manage so as to have all the pipe outside the room, or use a smaller stove?—A. R.

Frame Mitre.—NEMO.—There is a very useful mitre-cutting machine made and patented by Booth Brothers, Dublin. The usual tools used by frame makers are a cutting block, shooting block and plane, vice, hammer, bradawls, glue-pot, and tenon saw. You can buy the tools of any respectable tool maker at reasonable cost.—G. R.

Overmantel.—IMPROVER.—The cry nowadays is: "Don't give us anything requiring much labour," which, as a truism, can be applied to almost every trade. I have specially prepared the design herewith given for you, and have purposely avoided what by some would be termed an overflow of elaboration; but at the same time I have endeavoured to avoid plainness. I think that better effects can be obtained by a judicious use of variously shaped shelves, than by having each and every shelf of one particular pattern; and I have had slight proof that my notions are not far wrong, as I am constantly supplying new designs of this class of goods to master workmen, and find that the articles made accordingly meet with a readier sale than those in which the shelves are all of one character. The break canopy, or, more strictly speaking, the double canopy, will make a difference in the appearance of the job to the usual run of overmantels. The general practice is to have the uprights and cross rails about ¾ in. thick, and 1½ in. wide. All will be rabbeted at the back as in section, Fig. 6, to receive the glass and wood panels, which, as perhaps you know, will be secured in place by thin backboards. The joints will be mortises and tenons, which I have explained by Fig. 8, although it is probable that you know what the meaning of the term is. You will find it necessary to cut away some portion in front of the

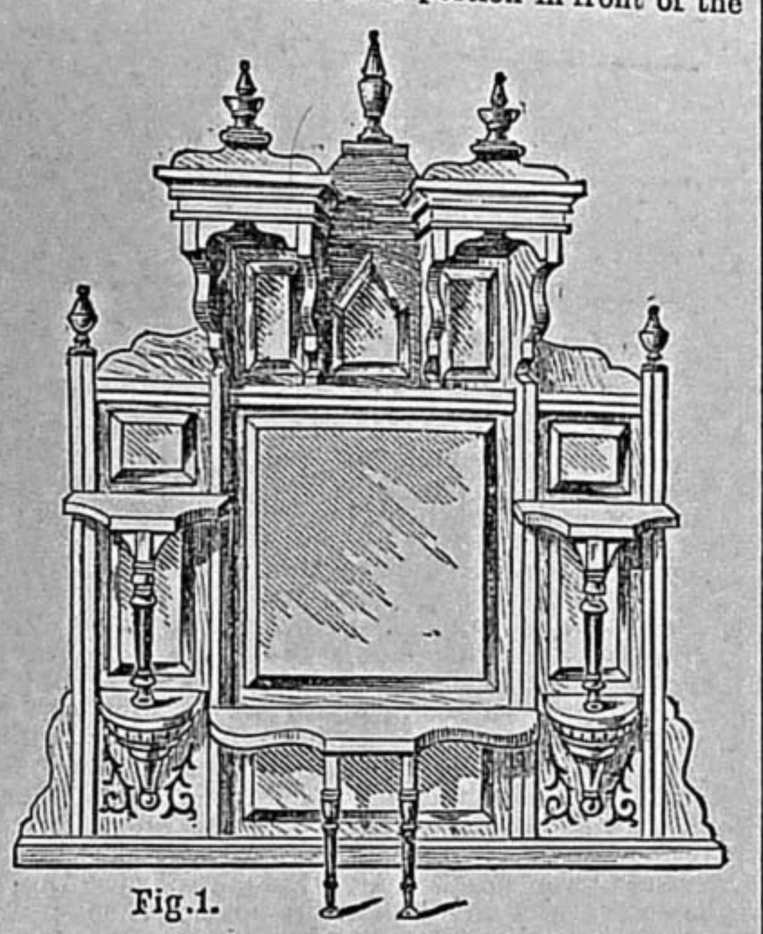

Fig. 1.

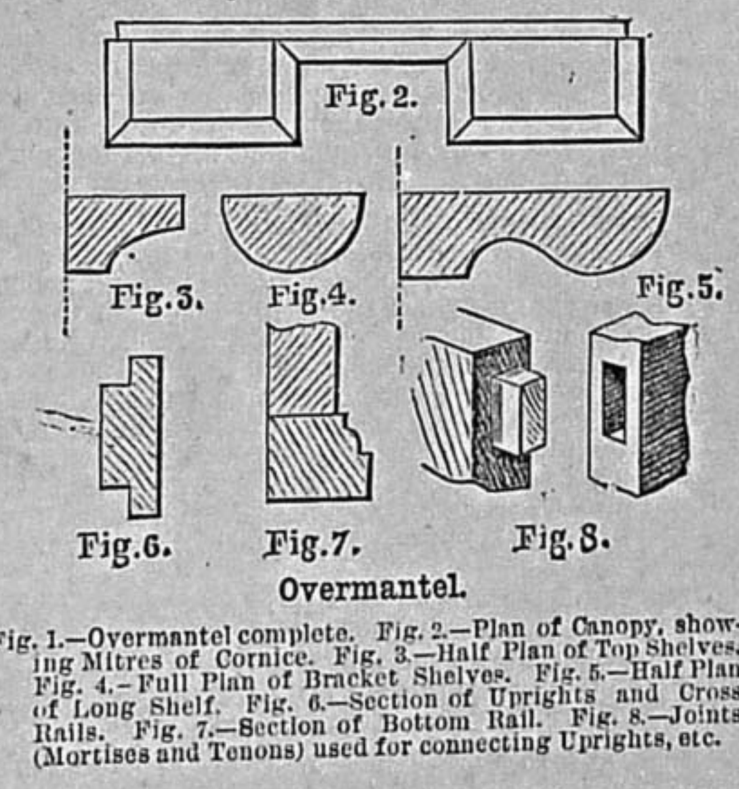

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Overmantel.

Fig. 1.—Overmantel complete. Fig. 2.—Plan of Canopy, showing Mitres of Cornice. Fig. 3.—Half Plan of Top Shelves. Fig. 4.—Full Plan of Bracket Shelves. Fig. 5.—Half Plan of Long Shelf. Fig. 6.—Section of Uprights and Cross Rails. Fig. 7.—Section of Bottom Rail. Fig. 8.—Joints (Mortises and Tenons) used for connecting Uprights, etc.

ends of the cross rails, which you will understand whilst working. For the half-round bracket shelves, a large turned ornament cut in halves will give you what you require. The top shelf at each side will be as in Fig. 3, and a dowelled column will connect the two. If you should happen to be ignorant of what a dowel is, read my article "Combined Music Stand, etc.," No. 35, Vol. I., pages 552 and 553. The front pair of pillars will also be dowelled into the shelf above them. At the extreme top of the framework the rail will be a rather wide one, and against it will abut the canopy top, a plan of which, and the way to mitre up the cornice, is shown in Fig. 2. All the shelves will be screwed on from the back of the job. They need not be very thick. The bottom rail will not be so wide as the remainder but will be thicker, so that the front of it may be moulded (Fig. 7). The sizes you had better work out for yourself, taking the length of your mantelpiece as a guide. I do not know of a list exclusively of joiners work.—J. S.

Binding. — H. C. (*Notting Hill*).—It is rather difficult to give you the required information in "Shop," for the simple reason that space cannot be spared for giving lengthy articles, and to give all that you require would constitute an article of no small dimensions. However, I will do what I can under the circumstances. To prepare your books for sewing in the manner adopted by the trade, they will require to be refolded, *i.e.*, every sheet will have to be taken and folded, carefully placing the pages exactly over each other. Take, for instance, the first number of WORK and lay it open upon the bench or table before you with the pages 8 and 9 uppermost. Lift up two sheets (I am presuming that the number has been cut) by the corner, and hold them up to the light, and place pages 10 and 11 exactly over each other; when this is done place them upon the table again, holding them tightly all the time, and place page 9 upon page 8, and draw the folder down the fold at the back and lay aside. Lift up the other sheets and place page 14 upon 15 as before and fold. Now turn this last part over upon the table with the front uppermost, and take the part folded first and laid aside, and place it inside, taking care to have pages 4 and 5 lying evenly upon each other. As the advertisement page at the back seems to have been an eyesore to some folks, it could be removed at this stage by cutting it off and pasting the second page carefully along the back and placing it upon the third page. But as this advertisement is paged with the book it will be best to allow it to remain. Personally, I do not think that it detracts from the value of the book in any way, though my taste in this respect may seem a little abnormal; the advertisements, although they may not add to the embellishment of the book, certainly add to the usefulness of such a book as WORK. The whole book is refolded as instructed, and rolled, beaten, or pressed, according to circumstances. Afterwards it is placed in the lying press between two wooden boards and five or seven grooves cut in the back with a saw, three or five for the bands, and two for the catching stitches. Three of five bands are now to be set upon the bench according to the style of binding (see WORK, Vol. II., page 43, for handy bench), and commence at the bottom of the sheet, after having placed it upon the bench with the grooves close up to the bands, and sew with good thread, bringing the needle out at the top side of the bands and putting it in again at the under side when the top has been reached; place another sheet and go down again to the bottom and fasten up, and so on until the entire book has been sewn. I hope these instructions will help H. C. This operation is more fully explained in the articles which are now appearing. What an amount of satisfaction our Editor must derive from your assurance that you are satisfied with WORK!—G. C.

Transfers for Slides.—S. C. W. (*Marsden, Huddersfield*) writes in reply to A. E. B. (*Cromer*) (see page 309, Vol. II.):—"J. Barnard & Son, 19, Berners Street, W., have some very good chromo-printed pictures for making slides at 3s. the dozen. I can recommend them."

Glass and China Painting.—C. M. (*West Brighton*).—In asking for a few particulars of glass and china painting, you do not say if you wish to paint in permanent colours, nor what you understand by "ordinary paints"—house paint, or oil, or water colours as used for painting pictures. Supposing you mean oil colours in tubes, you *can* paint upon glass and pottery with these, but you cannot use the articles afterwards: they must be kept for decorative purposes; if well executed, they look very nice, and just now glass frames for holding photographs and screens fitted with glass are sold to be painted in oils; mirrors are also painted that way, and many use oil colours for painting upon china plates; but proper colours are sold for this purpose, called, "ceramic colours," and if you wished to paint plates which would be used and washed—such, for instance, as a dessert service—these *must* be employed, as after the plate is painted it is sent to be fired: that is, heated in a kiln, until the colours are fused; they are then permanent, and will last as long as the plate itself; and even when the piece is only used for a decorative purpose, it is much better to employ ceramic colours, as there is a delicacy and beauty belonging to them which cannot be obtained with other paints. You would require for this work a few bottles of china colours (Hancock's Worcester Ceramic Colours I can strongly recommend from personal use), brushes (camel-hair and water-colour sables), palette knife, and a few other things. If you think of taking it up, I should be glad to give you a list of the things required, and also of the most suitable colours, if you let me know in what direction your task lies: *i.e.*, landscape, flower, or figure painting. Your chief difficulty will be to judge the colours properly, as they change in the firing, some very much. Your best plan would be to procure a white tile; divide this into a certain number of squares, fill up the first few squares with your different colours, then mix the primary colours together, then different combinations, until you fill the tile, writing the name of each colour or colours under each one; send it to be fired, then when you are painting you can have this before you, and judge how your colours will look when finished. It is impossible to give full instructions in "Shop" for china painting, but if a sufficient number were interested, I should be glad to write an article upon the subject, with the Editor's permission; in the meantime, if you are in any difficulty, or there are any other matters you wish to know, write again, and I shall be pleased to explain to the best of my ability. I may say Hancock's new colours only require mixing with water; these I prefer, as in my experience they are not so liable to blister in the firing; with turpentine, fat oil, spirits of tar, etc., great care has to be exercised. A great part of the above will apply to glass painting of a permanent nature, such as is generally known as stained glass, but to describe it would require as long an article as upon china painting.—W. E. D., JR.

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Silicine Glass Paints.—C. E. H. O. (*York*).—Silicine materials may be obtained from F. Bölian, 21, Featherstone Street, City Road, London, E.C., or from A. R. Hicks, 23, Upperhead Row, Leeds.

Canvas for Canoe.—T. D. (*Inverness*).—I would suggest that No. 1 canvas would be the best quality to use for a canoe, as from its strength it takes paint and wears better than any other quality. It is somewhat stiff, but when in place and given three coats of paint, will wear and last well. I have seen several canoes built with this canvas for a covering. —L. Y.

Regilding Frames.—A. S. (*Wolverhampton*).—Take your picture out of the frame and begin thus (of course, assuming it is an English gold frame):—Take a basin of lukewarm water and wash it well, taking special care that all dirt is removed from the deep ornamental parts; give it two coats of thin whiting and size, and when dry a coat of red gilders' clay, as the colour helps to give the gold a more brilliant colour. Then spread evenly a coat of gilders' oil of gold size, and let it lay for about twelve hours, when it is ready to apply the gold leaf. Then take your book of gold and blow leaves upon a gilder's cushion, as many as you please or require for the work; then with a tip pick the leaf up and place upon the frame in position, dabbing into the ornaments with cotton wool. When entirely covered, let it lay for a few hours to thoroughly get dry; then brush off with soft brush the superfluous gold, and size over with clear vellum size and let it dry, when your frame is ready to receive the picture.—G. R.

Taking out a Patent.—A. C. (*Peterborough*) wishes to know how to proceed in patenting his invention. He should get No. 35 of WORK, and read the article "Taking out a Patent" (Vol. I., page 545). If there are then any points on which he may still be in doubt, I shall be happy to do my best to solve them for him in "Shop."—C. C. C.

Shoe Cement and Burnish.—Ordinary writing ink is used to stain the bottoms of boots. Two or three coats may be applied; afterwards polish with warm irons and heel-ball till the requisite gloss is obtained. Sand's cement is used for repairing uppers. The cement may be had from the leather-sellers in twopenny bottles, or from J. H. Cooper, 35, Caledonian Road, King's Cross, London. The piece to be put on is pared down thin, especially at the edges, and the edges of the hole the same. It should be clean and a little rough. The boot and the piece are then warmed and the cement made warm and applied to the leather, and this is well pressed together. It is afterwards finished off with the warm iron and heel-ball, to hide any imperfections. A journal of boot and shoe making is published, called the *Cordwainer*, which may be obtained through any bookseller.—J. M.

Work on Dyeing.—G. C. (*Salford*).—You should advertise your book on the above subject in our "Sale and Exchange" columns. CROQUILICOT would then doubtless see your advertisement.—ED.

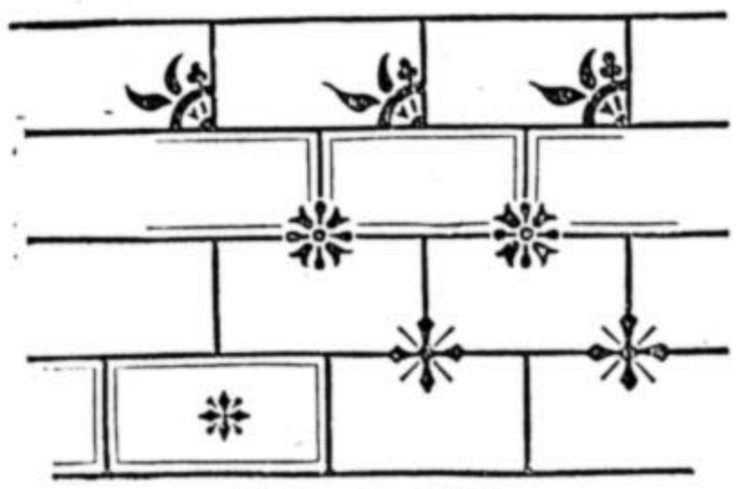
Lantern Slide Transfers.—W. G. (*Cardiff*).—I am sorry I cannot satisfy W. G. as to addresses of a manufacturer of transfers for lanterns. I believe they are chiefly of German make. If W. G., however, will write to Messrs. Lancaster, Colemore Row, Birmingham, who deal in these things, I have no doubt he may get the information needed. —O. B.

Gas Blowpipe.—STEREOTYPER.—The blowpipe that you inquire about was sketched from a home-made one that I made some years ago. I do not know of anyone who sells blowpipes exactly like it; but no doubt you could get one the same in principle, if not in construction, from Mr. Fletcher, Thynne Street, Warrington. It would not be very difficult to make one, and would cost only a trifle, say about 2s. and your time—which, of course one does not reckon when doing such jobs as these. You would simply want a ⅜ equal gas tap, a piece of ⅜ brass tube about 8 in. long, with a thread on one end of it, a piece 3 in. long with a thread on each end, a ⅜ obtuse elbow, and an ordinary brass blowpipe; screw the two pieces of tube into the tap, screw the elbow on to the longest piece, drill a hole in the angle of the nose-piece or elbow large enough to allow the blowpipe to be put through, and solder it round the hole and along the tube, and it is complete, with the exception of the hook, which is easily made and fixed.—R. A.

Sheet Steel.—C. E. S. (*Shipley*).—You will be most likely to obtain the material in small quantities from some local saw manufacturer.—F. C.

Harp.—C. L. (*Glasgow*).—What you require is a three-quarter or half-size harp; but it would be impossible, owing to the limited space at command, to do justice to the subject in "Shop" columns. Even the simplest are very difficult to make, whilst it is well-nigh hopeless for an amateur, unless he is a mechanician of rare ability, to attempt the construction of the action. Single-action harps, such as you want, are frequently to be met with at musical instrument dealers in all large towns, and may be purchased for a few pounds. If you are unable to obtain what you require in Glasgow, write to Messrs. Dawkins & Co., Charterhouse Street, London, who will doubtless be able to supply you.—R. F.

Papering and Painting.—E. H. S. (*Plymouth*).—Probably you have derived some assistance from papers which have appeared since you wrote. Your painstaking and explicit letter shall, however, be fully answered, and I hope the information will be in time for your purpose. I take it the porch you allude to is between the outer and inner door. For this, paint is certainly preferable. Paint it three or four coats, if it is thoroughly dry, according to instructions given in painting billiard room walls. You can make, doubtless, a fair imitation of either grey or pink granites by coating the wall with a ground colour of pink (made with white lead and Venetian red) and then with a piece of honey-comb sponge, marking it when dry with first white and then black paint. Black and white spotted upon a medium grey, or lead colour, ground will give an easy imitation of grey granite. A coat of varnish for finishing is advisable. Granite is scarcely what I would use myself, it is rather heavy and a little inelegant. If the work was painted a plain bath-stone colour, the intersecting



Design for Wall.

lines being run in with dark red, you would get a more tasteful effect. If you can draw a little, and cut a simple stencil, better still. You can then carry out the idea this rough sketch will convey. Use dark red or brown for lines and ornament also. You would only use one design, and could easily manage a simple pattern by the aid of a compass. Keep them smaller in proportion rather on your wall than I show. The lines can be made with a straight-edge and lining fitch (see "Painters' Brushes"). I wouldn't advise an attempt to imitate any marble, it would probably result in a daub. Walls should be coated with glue size before being papered. Paste is best made with a small knob of alum in the boiling water used for mixing. Certainly, if you can afford it, varnish hall and kitchen papers. You will not get a paper fit or worth varnishing for much under 1s. per piece. Don't use good varnish on a common paper; if varnishing at all, have a decent article. Sanitary papers, from 1s. per piece upwards, are good value, and can be sponged but not washed. Paper must be twice coated with patent size previous to varnishing. The size must be applied in liquid form, hence the print of the paper must be made for that purpose, so that it will not rub off.—DECORATOR.

Cleaning Marble Slab.—G. B. (*London*).—The "marks of age" which G. B. wishes to remove are, it may be concluded, mainly smoke stains. The best way to remove these is held to be either to put the marble in water or to bury it in wet sand (the latter by preference), leaving only *just* the surface exposed; and on that surface to sprinkle powdered whiting. The moisture rising through the marble drives the discoloration into the whiting. Completely to get free of old and deeply-seated stains is, however, often no easy matter. Mere surface discoloration is most readily removed with American potash.—M. M.

Brazing Saw Maker's Address.—J. B. (*Sunderland*) asks for the address of Mr. Duncan, whose brazing machine was noticed in WORK, No. 72. If he will look up that number, he will find the address given in the second line of the notice.

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—G. B. (*Islington*); NOT AN ELECTRICIAN; PHOTO; E. D. (*London, W.C.*); H. M. F. (*Colchester*); ENGRAVER; H. S. (*Birmingham*); R. J. B. (*Gateshead*); F. C. S.; S. J. S. (*Frome*); J. M. (*Manchester*); J. T. A. (*Rochdale*); JACKO; W. W. (*Cleator*); OLD SUBSCRIBER; J. S. (*Ilbeston*); X. Y. (*Rochdale*); E. M. (*Barnstaple*); MECHANIC; J. K. (*Durham*); G. H. (*Camberwell*); INQUIRER; EXPERIMENT; J. S. (*Ramsbottom*); A. R. (*Scorrier*); X. Y. Z.; L. M. S. (*Hebden Bridge*); J. L. (*Wigan*); T. W. (*Birmingham*); A WOULD-BE ELECTRICIAN; SMOKER; T. A. (*Lancashire*); E. C. M. (*Ipswich*); J. D. (*Glasgow*); A. T. G. (*London, N.*); H. L. (*Reading*); SULPHO-CYANIDE; CARPENTER; R. D. (*London, S.W.*); F. K. (*Woodbridge*); W. H. D. (*Portsmouth*); M. H. (*Withington*); F. M. (*London, N.W.*); CYCLIST; W. H. (*Ponder's End*); J. McM. (*Edinburgh*); A. G. F. (*London, N.E.*); W. L. (*Tilbury*); AMATEUR ELECTRICIAN; J. W. (*Middleton*); C. L. (*Brentwood*); H. M. R. (*Chester*); G. W. (*Brockley*); L. S. (*London, S.E.*); NOVICE; TINNER; A SUBSCRIBER FROM THE BEGINNING; M. M. C. (*Glasgow*); W. W. (*Glasgow*); W. B. (*Newport*); W. B. L. (*London, S.E.*); C. B. (*Clerkenwell*); SAWYER; NED; ONE IN TROUBLE; MILL; J. H. D. (*Luton*); W. A. (*Manchester*); H. D. (*Kentish Town*); J. G. (*Glasgow*); H. R. (*Bacup*); A. H. (*Blackheath*); BIKER; D. J. C. (*London, E.*); E. Y. S. W. (*Weybridge*); J. H. (*Birmingham*); W. B. (*Preston*); W. H. (*Gateshead*); W. W. (*Canonbury*); J. M. (*Newcastle-on-Tyne*); ECONOMIC; H. B. E. (*Leicester*); G. B. (*Clapham*); SADDLER; C. T. (*Maidstone*); E. G. (*Dalston*); J. W. T. (*Birmingham*); SADDLE; A. J. J. C. (*Oldham*); J. H. (*Glasgow*); H. J. L. J. M. (*Ealing*); A. A. S. (*Leeds*); P. D. (*Bootle*); RAPIER; P. P. & Co. (*Manchester*); A. C. C. (*Essex*); AMATEUR; H. M. R. (*Chester*); WAX; W. J. G. (*London, N.*); OSWALDSTREE; X. Y. Z.; J. W. B.; R. T. N. (*Shields*); W. E. J. (*Chippenham*); R. L. (*Ruabon*); W. T. C. (*Tamworth*); J. N. (*London*); W. J. L. (*Bow*); H. M. (*Manchester*); J. J. H. (*London, N.*); T. B. (*Dover*); W. H. G. (*London, N.W.*); G. J. T. (*Fulham*); J. W. (*Barnsbury*); M. H. (*York*); S. C. (*Sheffield*); W. P. (*Tipton*); READER (*Belfast*); A READER OF "WORK"; C. J. T. (*Oldham*).

"WORK" EXHIBITION.

(1890-91).

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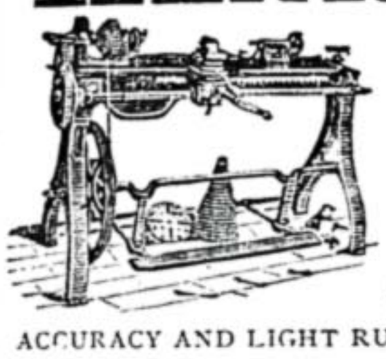

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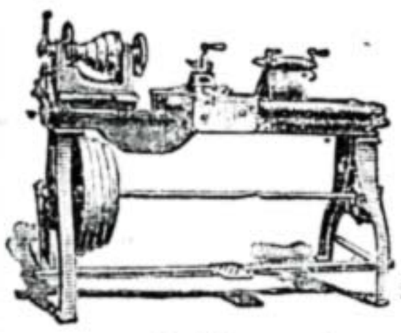

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